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ARTICLE

Index Evaluation and Application of Green Innovation Ability in the Pearl River Delta Science and Technology Park

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ABSTRACT

This paper takes the green innovation in 15 science and technology parks in the Pearl River Delta region as a sample, uses the AHP-Fuzzy evaluation method to construct an index evaluation model with 5 first-level indicators and 9 second-level indicators, and analyzes the essential connotation and key influencing factors of green innovation ability in science and technology park. The research found that among the first-level indicators, "industrial innovation", "incubator innovation" and "policy innovation" ranked among the top three key factors. Among the second-level indicators, the three factors of "enterprise incubator innovation", "government policies and fiscal and financial policies" and "the development of new industries and emerging industries" have a significant impact on the innovation capabilities of science and technology parks. Accordingly, some suggested measures are put forward to provide theoretical and practical guidance for improving their green innovation ability. The main innovation of this paper is to construct an evaluation model of science and technology park suitable for the green innovation ability of science and technology park according to the social and economic development of the Pearl River Delta city belt and to test its effectiveness. In view of the technology, complexity, ambiguity and pluralism of the evaluation index construction of green innovation ability in science and technology parks in practice, the index evaluation model and application strategy in this paper hope to provide a theoretical reference for the

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park operators to improve their benefits and promote the development of regional industrial clusters.
Keywords: Science and Technology Park; Green Innovation Ability; Index Evaluation; New Quality Productivity

1. Question Presentation and Literature Review

1.1. Connotation of Green Innovation Ability of Science and Technology Parks

In the era of VUCA, the global sustainable use of resources and ecological environment contradiction, countries need to integrate economy, society, science and technology, resources and ecological environment factors, the implementation of new quality productivity as the connotation of economic development mode, which requires further study of the elements of sustainable development characteristics and adaptation mechanism, formulate related strategy, provide theoretical support for green innovation ability. In the long run, the regional innovation capacity formed by the sustainable development of the infrastructure and industrial parks is of great importance to the realization of the goal of social and economic sustainable development.

Many documents explain the connotation of the green innovation ability of the science and technology park. It is generally believed that the concept of environmental protection and resource conservation is integrated into all links of the science and technology park, covering technology research and development, product design and other aspects, and involving multi-level innovation such as green technology, process and service. Under the condition of new productivity construction and sustainable development, this paper thinks green technology park innovation ability is its construction institutions to adapt to the requirements, through change resource utilization mode series of measures, infrastructure, supporting facilities construction and technical and economic integration innovation of comprehensive business activities formed by the innovation ability. As an important engine of regional economic development, the construction of innovation ability of science and technology park is related to the sustainable development of regional society and economy. In recent years, many science and technology park construction organizers have put forward the second entrepreneurial growth plan, transforming to new quality productivity and green and sustainable development, reflecting the urgent need and dilemma of building innovation capacity. All parks expect to avoid repeated construction and low-level competition, form characteristics and core competitiveness, and improve the ability of industrial clusters.

This paper puts forward the concept of "science and technology park green innovation ability", study how to meet the requirements of low carbon sustainable development, with new quality productivity development as the guideline, strengthening the core ability construction, using AHP-Fuzzy evaluation method to establish the Pearl River Delta science and technology park innovation ability evaluation model, to reposition the park function development, guide the green innovation activities, reduce energy consumption and pollutant emissions, realize environment friendly innovation development mode, form the park area growth and core competitiveness.

1.2. Theoretical Basis for the Green Innovation Ability of the Science and Technology Parks

The main theoretical basis of the green innovation ability of science and technology parks is as follows:

1. Ecological modernization theory: Integrate ecology and economy through technological and institutional innovation, promote the modernization and transformation of the economy in accordance with ecological principles, and enhance the green innovation capacity, such as developing clean energy and circular economy in developed areas to enhance their competitiveness.

2. New quality productivity: Chinese President Xi Jinping pointed out, "High-quality development requires new theories of productive forces for guidance. New quality productive forces have taken shape in practice and demonstrated a strong impetus and support for high-quality development. We need to summarize and generalize them theoretically to guide new development paths"[1]. He also pointed out: "New productive forces are primarily driven by innovation, emerging from revolutionary technological breakthroughs, innovative allocation of production factors, and in-depth

industrial transformation and upgrading. They fundamentally manifest as qualitative leaps in laborers, means of labor, objects of labor, and their optimal combination, with a substantial enhancement of total factor productivity serving as their core hallmark. Characterized by innovation, quality-driven development, and representing advanced productive forces in essence"[2].

3. Sustainable development theory: It emphasizes the coordination and unity of economy, society and environment, and needs to explore innovative modes in various aspects from the perspective of green innovation. Domestic pressure of growth and resources and environment, put forward green and low-carbon strategies; foreign countries also actively explore ways, such as Norway's excellent environmental protection, the United States strengthens regulations to support green industries, and the international community to promote the realization of global goals.

4. Green technology innovation system theory: Focus on the whole process of green technology research and development, diffusion and application, and all cooperate to promote its development and enhance the ability of green innovation, such as the collaborative operation of the government, scientific research institutions and enterprises.

5. Porter's hypothesis theory: Appropriate environmental regulation can stimulate enterprise innovation, reduce governance costs, develop green products, and improve regional green innovation ability, such as strict regulation of regional enterprises to increase investment in green research and development.

In short, the theoretical basis of green innovation ability covers many aspects, and actively explores the regional sustainable development path at home and abroad. The construction of green innovation ability of science and technology parks has many characteristics. This paper will study relevant evaluation methods and models to promote the improvement of its ability, so as to help the theoretical development of park construction and management theory.

1.3. Relevant Literature Review

1.3.1. Research on the Influencing Factors and Evaluation of Regional Competitiveness and Green Innovation Ability of Science and Technology Parks

- Foreign representative competitiveness model:

  Porter[3] raised the "diamond model".

  International Institute of Management and Development (IMD), Lausanne, Switzerland (1989)[4, 5] put forward the national competitiveness model, the core is the enterprise competitiveness.

  Ian[6] proposed the urban competitiveness model, which organically combines the four elements of departmental trends, company characteristics, business environment, innovation and learning, and the urban competitiveness is measured by the social employment rate and production as the intermediate measurement standard.

- Domestic related research:

  China Urban Competitiveness Research Group[7] compared the competitiveness of the 51 key cities from 12 aspects, such as environment and infrastructure.

  Based on the index system of comprehensive strength, development and ecology, factor analysis and cluster analysis are used by Lv and Hao[8] to evaluate the competitiveness of provinces and regions.

  From the four dimensions of innovation research and development and innovation service, 18 elements are selected by Liu et al.[9] to construct the evaluation index system of innovation and development ability of agricultural science and technology park.

  Fan et al.[10] took 13 national agricultural science and technology parks in Chongqing as the object, and comprehensively evaluated the innovation ability index and development situation of agricultural science and technology parks from five aspects, such as innovation resource aggregation.

  Ma[11] selected the four indicators that affect the innovation ability of high-tech parks as the input targets, the number of patents granted and the total industrial output value as the output targets, and used the BBR model in the data envelope analysis method for evaluation.

1.3.2. Research on New Quality Productivity and Sustainable Development

- Domestic study status:

  At present, the domestic academia on sustainable development and the connotation of new productivity development has no consensus recognition, the main-

stream view is that green, sustainable development is low carbon emissions, low pollution meet the requirements of social sustainable development of economic model, its core is to meet the requirements of low carbon development technology and economy and management innovation.

Hu[12] pointed out that the new quality productive forces are the advanced productive forces with scientific and technological innovation as the core element, and the comprehensive upgrading and transformation of the jump and evolution of the traditional productive forces.

Du[13] proposed that new quality productive forces are a new type of high-level advanced productive forces accompanied by scientific and technological revolution and industrial transformation. To accelerate the cultivation, development and expansion, the core is to build "high-tech productive forces", "high-efficiency productive forces" and "high-quality productive forces".

- Foreign research:

  Directly on the green innovation in industrial areas or science and technology parks, the first economist Schumpeter[14] refers to the technological and economic innovation activities related to the research, development and production of new processes or products.

1.3.3. Domestic Research and Deficiencies Related to the Independent Innovation and Growth of Science and Technology Parks

In China, Chen[15] mainly studies the innovation mode of science and technology park from the perspective of science and technology park, and proposes the agglomeration of small and medium-sized enterprises in the park, but does not study the constraints of sustainable development; Zuo[16] implements the construction measures of the secondary business incubation and innovation base and the technological economy innovation mode of the science and technology park, and does not study the sustainable development status; Yang and Feng[17] propose the technological and economic innovation mode led by research and development and science and technology, and the sustainable development situation is not studied.

1.3.4. Summary of the Overall Study Status

Although there are many theories on the growth strategy and the construction of innovation capacity of science and technology parks at home and abroad, there are relatively few literature studies from the perspective of new quality productivity and sustainable development.

2. Evaluation and Application Status of the Innovation Ability Index of Science and Technology Parks at Home and Abroad

2.1. Practical Experience of Innovation Capacity Construction of Foreign Science and Technology Parks

According to Sun and Wu's[18] research on the development of the science and technology parks in Italy: there are 35 science and technology parks in the country, whose main technical and economic development strategies include: attaching importance to the role of government in science and technology parks; establishment of government departments, research institutions, universities, science and technology enterprises and financial institutions, responsible for the construction and development of science and technology parks, strengthening information management, knowledge management and innovation exchange; introducing private capital to establish business incubators. In addition, according to the aforementioned Chen Zhaofeng, the technical and economic development measures of the Silicon Valley technology park in the United States include: strengthening the function of the government in the "cooperation between government, industry, learning and research"; emphasizing the intervention of venture capital; emphasizing the accumulation of scientific and technological talents; and emphasizing the cooperation with universities.

2.2. Analysis of the Bottleneck Factors Restricting the Construction of Green Innovation Capacity in Domestic Science and Technology Parks

The Yangzhou CPPCC research Group[19] shows that there are more than ten reasons for restricting the technolog-

ical and economic development of science and technology parks, among which the main technical and economic bottleneck factors related to the construction of green innovation capacity for the sustainable development of science and technology parks are more than 10 as shown in **Table 1**:

Table 1. Main bottleneck factors in the construction of green innovation capacity in science and technology parks.

1	The leading industry is unclear, the industrial chain is short, and the industrial value-added ability is low.	1
2	Industry categories are more miscellaneous, and the industry distribution is relatively scattered.	8
3	The construction level of business incubators is low.	2
4	Low industrial chain, low and weak product innovation ability.	3
5	First-class R & D team is too small, and there is a lack of technical leaders.	6
6	The investment mechanism is not perfect, and the financing channel is relatively single.	10
7	The function of the public service platform is poor, and the infrastructure construction of the industrial agglomeration carrier is not perfect.	9
8	Low independent research and development ability, fewer brand assets and intellectual property rights.	4
9	Enterprises lack experience in technology innovation management.	5
10	The responsibilities of government and enterprise are fuzzy, and the park management system is rigid.	7

Source: The data were compiled by this article.

Qualitative research usually employs grounded theory, interpretive phenomenology or the Delphi expert opinion method. This research adopts the Delphi method, which means that the expert group goes through multiple rounds of scoring separately → group summarization → scoring again → group summarization again. Among them, the expert group consists of 2 professional scholars engaged in science and technology park management research, 2 staff members from the investment promotion management department of the science and technology park, and 2 managers of the enterprises settled in the science and technology park, totaling 6 experts (hereinafter referred to as the "6-person expert group"). Using the Delphi method, the specific ranking of the above 10 hindering factors in the science and technology park by this 6-person expert group is as follows: Unclear leading industries, low construction level of enterprise incubators, low industrial chains and weak product innovation capabilities rank among the top three, and they are the main factors with relatively large degrees of bottleneck constraints.

Therefore, for the development of the green technology innovation capacity of the science and technology park, it is necessary to focus on solving problems such as unclear leading industries and insufficient innovation in incubator construction.

2.3. Analysis of Green Innovation Capacity Development Status and Driving Factors in the Pearl River Delta Science and Technology Park

The following **Table 2** summarizes the development of green technology capacity in the 15 science and technology parks in the Pearl River Delta:

Table 2. Summary of the development of green innovation capacity in the Pearl River Delta Science and Technology Parks.

Order Number	Science Park Name	Major Green Innovation Measures
1	Dongguan Songshan Lake High-tech Industrial Development Zone	1. Green concept and industrial upgrading: integrate green development into genes, formulate industrial access catalogue, select high-quality projects, promote high-end and green industries, and attract leading enterprises to build R & D and production bases according to green building standards. 2. Environmental access and supervision: issue environmental access documents, strictly examine the energy consumption of new park projects, carry out regular environmental inspections, and use online monitoring equipment to monitor emissions. 3. Solid waste management: Build an intelligent management platform of big data, carry out the creation activity of "no waste cells", encourage waste reduction at the source and improve the comprehensive utilization rate of solid waste.
2	Shenzhen High-tech Industrial Park	1. Enterprise energy-saving action: enterprises take the initiative to replace energy-efficient production and office equipment. 2. Green building practice: newly built and renovated buildings strictly implement green building standards and integrate energy-saving design concepts. 3. Ecological landscape construction and maintenance: Create an ecological landscape area, plant local plants, and use sponge city concept facilities to collect, purify and infiltrate rainwater.

Table 2. *Cont.*

Order Number	Science Park Name	Major Green Innovation Measures
3	Guangzhou Science City	1. Promotion of new energy vehicles: Construction of a charging pile network, to carry out new energy vehicle rental business. 2. Effectiveness of enterprise environmental governance: Enterprises attach great importance to waste gas treatment, adopt advanced treatment technology, and build a reclaimed water reuse system to improve the utilization rate of water resources. 3. Introduction of green industry projects: formulate investment attraction policies and give priority to the introduction of green and low-carbon industry projects.
4	Foshan Zhongde Industrial Service Area	1. Application of green energy-saving materials: green energy-saving materials are widely used in infrastructure and construction projects. 2. China-EU green technology cooperation: Build a platform for cooperation and exchange, hold matchmaking meetings and other cooperation projects. 3. Green technology transformation and application: establish a transformation service mechanism to provide whole-chain services for enterprises.
5	Huizhou Zhongkai High-tech Industrial Development Zone	1. Promotion of distributed photovoltaic power generation: policies to encourage installation, and enterprises adopt self-use and surplus power Internet mode. 2. Construction of reclaimed water reuse facilities: unified planning and construction, deep treatment of reclaimed water and extensive reuse. 3. Investment strategy of green industry: Formulate the investment catalogue of green industry, and give various preferential policies to enterprises that meet the requirements.
6	Zhuhai High-tech Industrial Development Zone	1. Low-carbon demonstration park project building: Create low-carbon concepts and technologies, and support the construction of rainwater collection and utilization systems. 2. Promotion of green construction technology: Promote green construction technology, and adopt prefabricated construction technology to reduce pollution and construction waste. 3. Environmental protection control and green supply chain management of enterprises in the park: formulate strict environmental protection standards, and require enterprises to establish an environmental management system for green management.
7	Zhongshan Torch High-tech Industrial Development Zone	1. Green upgrading of the traditional manufacturing industry: promote technological transformation of enterprises, for example, the electroplating industry adopts environmental protection processes to replace high pollution processes. 2. Park greening and ecological environment construction: scientific planning of greening layout, paying attention to the protection and restoration of the ecological water system.
8	Zhaoqing High-tech Zone	1. Exploration of biomass energy utilization: Using biomass waste to build biomass power generation projects. 2. Energy saving and consumption reduction actions for enterprises: carry out training and technology promotion, and encourage enterprises to implement energy-saving renovation projects. 3. Sewage treatment and reuse: Build sewage treatment plants, promote sewage reuse work, and build reclaimed water reuse pipe networks.
9	Jiangmen High-tech Zone	1. Application of green packaging materials: Enterprises explore the application of environment-friendly packaging materials to optimize the packaging design. 2. University-enterprise green innovation cooperation: Cooperate with universities and scientific research institutions to carry out green innovation projects. 3. Green industry incubation mechanism: set up an incubation base, and hold activities to explore green entrepreneurship projects.
10	Dongguan Water Town Characteristic Development Economic Zone	1. Ecological restoration project: implement dredging and other measures to restore the river ecology and plant aquatic plants to build an ecosystem. 2. Building waterfront green ecological space: building waterfront parks and slow greenways based on the water system. 3. Development of green logistics: Encourage logistics enterprises to use new energy vehicles and optimize distribution lines.
11	Foshan Chancheng High-tech Industrial Development Zone	1. Promotion of intelligent lighting systems: Promote intelligent lighting systems in public areas and light on demand. 2. Green process transformation of traditional industries: to promote the use of environmentally friendly production processes in traditional industries such as ceramics. 3. Research and development and promotion of green building materials: build a research and development center, research and develop green building materials products and promote their application.
12	Guangzhou Nansha District Information Science and Technology Park	1. Construction of Sponge City Demonstration Park: build sponge facilities such as rain gardens to enhance drainage capacity. 2. Building energy saving measures: the application of high-efficiency heat insulation materials, energy-saving doors and windows to reduce building energy consumption. 3. Research and development encouragement of green innovative products: policies are introduced to encourage enterprises to research and develop, and special funds are set up to support projects.
13	Shenzhen Nanshan Wisdom Park	1. High star green building: The building is planned, designed and constructed according to the high star green building standard, and the green concept is implemented in the whole life cycle. 2. Perfect garbage classification and recycling facilities: equipped with perfect classification and recycling facilities, and establish a closed-loop management system. 3. Advocate the shared office equipment and green office concept: promote the shared office equipment and advocate the concept of green office.
14	Sanshui Datang Town Science and Technology Park	1. Industrial green development: promote the implementation of major projects and the transformation of achievements, industrial clusters are listed in the provincial characteristic industrial clusters, enterprises are selected as excellent practice cases, and pilot certification of industrial creation. 2. Developing agriculture through agricultural science and technology: As a provincial agricultural industrial park, its innovation platform has been selected as the "national team", exploring the path of developing agriculture through science and technology, carrying out aquatic products projects, and cooperating with universities to build an industrial park.

Table 2. *Cont.*

Order Number	Science Park Name	Major Green Innovation Measures
15	The Guangdong-Hong Kong-Macao Greater Bay Area Youth Entrepreneurship Science and Technology Park	In the process of project construction, 22 green construction technologies have been adopted, such as BIM technology to optimize drawings to reduce the problems of errors and omissions and drawing collisions, improve the construction efficiency by more than 10%, and make the overall dust removal rate reach more than 40%. It is committed to building an intensive, ecological, diverse and flexible ecological science and technology industrial park benchmark.

Source: Data are from public information, compiled by this article.

Based on the development status of these science and technology parks and in accordance with the research views of Ye, Huan and Xu[20], the main driving factors for green innovation in science and technology parks mainly include:

1. Industrial transformation and upgrading;
2. Scientific and technological innovation;
3. Policy-guided innovation;
4. Improvement of park infrastructure and park functions: This includes the upgrading of infrastructure such as transportation, energy supply, and sewage treatment, which improves the efficiency of resource allocation and environmental governance capabilities;
5. Enhancement of the public's environmental awareness and environmental quality.

2.4. Model Construction and Evaluation Index Factors Affecting the Green Innovation Ability of the Pearl River Delta Science and Technology Park

Based on a comprehensive analysis of the situations described in 2.1, 2.2 and 2.3 mentioned above, the 6-person expert group formed a consensus through the Delphi method of multiple rounds of scoring and summarization, and summarized five first-level index factors and nine second-level index factors that affect the evaluation model of the green innovation ability of science and technology parks in the Pearl River Delta. The specific details are shown in **Figure 1**:

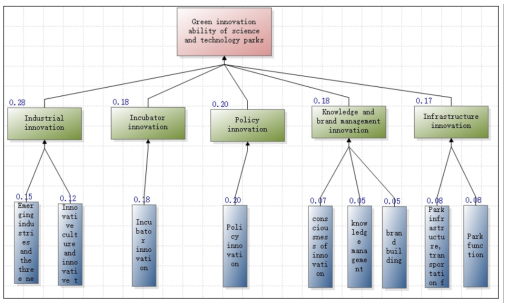

Figure 1. Hierarchical analysis system diagram of green innovation ability index evaluation in science and technology parks.

How scientific is the construction hypothesis of the index model of the green innovation ability evaluation model? It can be analyzed by quantitative comparison with the Porter Diamond model and IMD model showed in **Figure 2**:

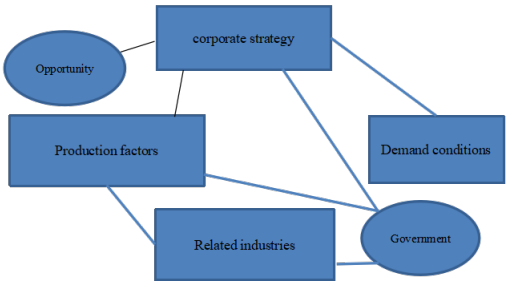

Figure 2. Diamond model diagram.

In 1990, Michael Porter put forward the famous Porter's Diamond Theory, also known as Porter's Diamond Model or Diamond Theory. This theory points out that the competitiveness of a certain industry in a country depends on four key factors: 1. factor conditions; 2. demand conditions; 3. firm strategy, structure, and rivalry; 4. related and supporting industries. 5. In addition, government and chance are two important variables that affect industrial competitiveness. Chance is uncontrollable, and the impact of government policies cannot be ignored. Therefore, grasping Porter's Diamond Theory is of great significance for formulating enterprise strategies.

- Determine common indicators and variables

Identify overlapping parts: In the model summarized in this article, industrial innovation overlaps with the relevant industrial elements in Porter's Diamond Model. For example, emerging industries and the "Three New" industries can be associated with the competitiveness of relevant industrial clusters in Porter's model.

Variable quantification: Assign specific quantifiable variables to these common indicators. For example, for the scale of emerging industries in industrial innovation, data such as the annual output value and annual growth rate of emerging industries can be used for quantification; for the

basic transportation facilities in the park, road density and public transportation coverage can be used.

According to the Lausanne-based IMD, the "World Competitiveness Yearbook" ranks the world's 60 major economies in an all-round way every year. Usually, the four items of "economic performance", "government efficiency", "business efficiency", and "infrastructure status" are further refined into 314 assessment indicators to determine the comprehensive competitiveness rankings of the 60 major economies in the world. This model sets relevant evaluation indicators from a relatively macro perspective, and it is more appropriate for evaluating economies at or above the national level. Among the four aspects emphasized by the IMD model, the green innovation competitiveness model for science and technology parks proposed in this article mainly has a corresponding relationship with industrial innovation, enterprise incubator innovation, policy innovation, and infrastructure innovation, refining and specifying the four indicators of the IMD model. In addition, according to the constituent characteristics of the core competitiveness of science and technology parks, the element of "knowledge and brand management innovation" has been added to more pertinently meet the needs of evaluating the green innovation competitiveness of science and technology parks at a more detailed level.

3. Index Evaluation of the Green Innovation Ability of Science and Technology Parks

The index evaluation of the innovation ability construction of science and technology parks must solve the problems of determining the first-level evaluation index, setting the weight, determining the assignment and setting the relevant value of the second and third-level subdivision index.

3.1. AHP-Fuzzy Comprehensive Evaluation Model

The above analysis shows that the green innovation ability of science and technology parks has many elements, different categories and levels, and the boundary of factor extension and attribute is blurred, which makes it difficult to simply and quantitatively evaluate. Moreover, due to different experiences, knowledge and positions, simple qualitative evaluation is difficult to produce appropriate conclusions. The latest research on this is the references [21–23], a framework based on computer vision that can replace the AHP-Fuzzy model to automatically evaluate green innovation capabilities by analyzing infrastructure conditions, green space coverage, and resource efficiency in real time. This approach minimizes subjectivity, enhances scalability, and provides sustained, quantitative insights into sustainable development. The fuzzy multivariate decision method can combine qualitative and quantitative research and adapt to the hierarchical analysis method, which can solve the fuzzy and difficult to quantify multi-factor comprehensive decision-making problem. Therefore, this study comprehensively uses the hierarchical analysis method and the fuzzy multiple decision-making method to construct the AHP-Fuzzy evaluation model to evaluate the innovation ability of science and technology parks.

3.1.1. Modeling Approach

1. Hierarchical analysis method (AHP)

Various factors in the comprehensive evaluation index system of green innovation ability in science and technology parks are interrelated and restricted, involving many factors that need subjective judgment, which is difficult to reflect in ordinary mathematical models. As a mature subjective empowerment method with many studies, widely applied and of great influence in the world, hierarchical analysis is a decision-making evaluation tool combining qualitative and quantitative. It can solve the difficulty of quantifying the subjective factors of this model, and the application is simple and feasible. Therefore, this study adopts its weight.

- The operational steps of the hierarchy of analysis

1. Build level analysis system model: decision makers first clarify task objectives to establish the decision-making target layer, then decompose the target task to establish the criterion layer (which solves the intermediate elements), and according to the elements of subordinate relations and actual situation, further decompose the criterion level, until the corresponding specific solution alternatives are reached. In principle, the hierarchical structure is generally divided into three categories: target layer, middle layer (criterion layer), and scheme layer. The hierarchical relationship progresses layer by layer. See **Figure 1** for the typical level construction model.

2. Construct a pairwise comparison matrix between factors (Pairwise Comparison Matrix, PBM). Experienced authorities are invited to compare the various factors of the middle layer and the scheme layer according to the mutual relationship. According to the absolute number basic scale (as shown in **Table 3**), give the judgment results and obtain the judgment matrix, such as A_1.

If there are n B layer membership elements, the judgment matrix constructed is shown in **Table 4**, which follows the judgment matrix of all intermediate layers and scheme layers.

Table 3. Absolute number basic scale table.

Importance Degree Identification	Definition	Explain the Description
1	The importance is general	The two index factors have the same contribution to the target.
2	It's a little important	Experience and judgment think that the former factor is slightly better than the latter.
3	More important	Experience and judgment suggest that the former factor is more important than the latter.
4	Very important	The former factor is very important compared with the latter, and its advantages are often shown in practice.
5	Extreme importance	The most resolute assertion is that the former factor is the most important compared to the latter.
The reciprocal form of the above figures	The reverse of the above definition is reviewed in this paper metric.	The above described condition is changed to the corresponding value of the latter when compared with the former.

Source: Reference to this article

Table 4. Belonging to B1 of the judgment matrix form.

	B1	B2	...	Bn
B1	1	B12	B1i	B1n
B2	B21	1	B2i	B2n
...	Bi1	Bi2	1	Bin
Bn	Bn1	Bn2	Bni	1

Source: Reference to this article

- The PBM was checked for consistency inspection

The consistency index C.I., CI = (λ max–n) / (n–1) is calculated, where λ max is the largest feature root of the corresponding matrix and n is the order within the PBM;

B. Determine R.I. values from the values corresponding to n (Random Index), as shown in **Table 5**:

C. Calculate C.R. values (consistency ratio, B Consistency Ratio)

C.R. = C.I. / R.I.

When C.R. < 0.10, the PBM can be considered to have passed the one-time test, otherwise, experts should be invited to judge again and adjust appropriately until it passes the consistency test.

Table 5. The RI values of the average consistency index are shown.

n	1	2	3	4	5	6	7	8	9
RI	0	0	0.53	0.89	1.11	1.24	1.34	1.40	1.45

Source: Group decision making: Drawing out and rebuilding differen Beses, by T.L. Saaty and K. Peniwati, p. 26. Copyright 2008 by RWS Publications.

Fourth, the relative weight vector of PBM at each level is calculated, and the index weight of each level is determined. There are many mathematical methods to calculate the weight vector. This article is not detailed here; this paper will take "yaahp" software for calculation.

2. Fuzzy Multivariate Decision Theory (Fuzzy)

$$B.l. = \frac{\lambda_{max}-n}{n-1}$$

The theory of fuzzy set was originally proposed by Professor Zad (L. A. Zadeh) of the University of California in 1965. The implementation of fuzzy multiple decision method includes four basic steps: first, to determine the evaluated factor set U; second, to set the evaluation set V; third, to conduct single factor evaluation; fourth, to synthesize single factor evaluation for comprehensive evaluation.

3.1.2. Evaluation and Implementation

- Establish a set of level indicators (including rights) to be evaluated

Follow the implementation of the hierarchy analysis steps, combined with the previous data, the author made the science and technology park green innovation ability characteristic elements comparative analysis questionnaire, continuing to invite the above mentioned 6 expert panel. The above technology park innovation ability characteristic elements index, summary data build matrix, after sorting and revised data, see the following series of tables:

(Special note: In the following tables, the consistency ratios are not all exactly 0. Instead, many of them are values that are very close to 0. They become 0 after being rounded off to two decimal places when taking values.)

Sort the weight of the scheme layer elements to the decision objectives

List of alternative options and their respective weight are presented in **Table 6**.

Table 6. The ranking weight of the element in the scheme layer with respect to the decision.

Alternative Options	Weight
Incubator innovation	0.1949
Policy innovation	0.1906
Emerging industries and the three new industries	0.1360
Innovative culture and innovative talents	0.1088
Park infrastructure, transportation facilities	0.0925
Park function	0.0925
Consciousness of innovation	0.0676
Brand building	0.0591
Knowledge management	0.0580

Note: Consistency ratio: 0.00.
Source: This article research, similarly hereinafter.

The ranking weight of the first criterion layer elements on the decision objectives

List of first criteria layer elements and their respective weight is presented in **Table 7**.

Table 7. The ranking weight of element in the first criterion layer with respect to the decision-making objectives.

Criteria Layer Elements	Weight
Industrial innovation	0.2448
Incubator innovation	0.1949
Policy innovation	0.1906
Infrastructure innovation	0.1850
Knowledge and brand management innovation	0.1847

Note: Combined consistency ratio: 0.0005, (Calculation result aggregation, CI = weighted of the corresponding CIS of each expert).

- The statistical table of the PBM judgment survey data of the criterion layer is as follows: Due to the limited space of this paper, the scoring tables of the 6 experts were omitted but not directly included. According to the weighted arithmetic average method, the 6 experts were scored (each expert scored the same weight) with the following tables for each item:

Table 8 illustrates the judgement matrix, showing the relationship between the 5 first-level indicators.

Table 9 shows the judgement matrix for the first first-level indicator Industrial Innovation.

Table 10 shows the judgement matrix for the second first-level indicator Incubator Innovation.

Table 8. The judgment matrix after the assembly—Green innovation ability of science and technology parks.

Green Innovation Ability of Science and Technology Parks	Industrial Innovation	Incubator Innovation	Policy Innovation	Knowledge and Brand Management Innovation	Infrastructure Innovation	Wi
Industrial innovation	1	1.2564	1.2841	1.3257	1.3231	0.2448
Incubator innovation	0.7959	1	1.0221	1.0552	1.0531	0.1949
Policy innovation	0.7787	0.9784	1	1.0324	1.0304	0.1906
Knowledge and brand management innovation	0.7543	0.9477	0.9686	1	0.9980	0.1847
Infrastructure innovation	0.7558	0.9496	0.9705	1.0020	1	0.1850

Note: Consistency ratio: 0.0000; The weight of its impact on "Green innovation ability of science and technology parks": 1.0000.

Table 9. The judgment matrix after the assembly—Green innovation ability of science and technology parks.

Industrial Innovation	Emerging Industries and the Three New Industries	Innovative Culture and Innovative Talents	Wi
Emerging industries and the three new industries	1	5/4	0.5556
Innovative culture and innovative talents	4/5	1	0.4444

Note: Consistency ratio: 0.0000; The weight of its impact on "Green innovation ability of science and technology parks": 0.24.

Table 10. The judgment matrix after the assembly—Green innovation ability of science and technology parks.

Incubator Innovation	Incubator Innovation	Wi
Incubator innovation	1	1.0000

Note: Consistency ratio: 0.0000; The weight of its impact on "Green innovation ability of science and technology parks": 0.19.

Table 11 shows the judgement matrix for the third first-level indicator Policy Innovation.

Table 11. The judgment matrix after the assembly—Green innovation ability of science and technology parks.

Policy Innovation	Policy Innovation	Wi
Policy innovation	1	1.0000

Note: Consistency ratio: 0.0000; The weight of its impact on "Green innovation ability of science and technology parks": 0.19.

Table 12 shows the judgement matrix for the fourth first-level indicator Knowledge and Brand Management Innovation.

Table 13 shows the judgement matrix for the fifth first-level indicator Infrastructure Innovation.

Table 12. The judgment matrix after the assembly—Green innovation ability of science and technology parks.

Knowledge and Brand Management Innovation	Consciousness of Innovation	Knowledge Management	Brand Building	Wi
Consciousness of innovation	1	1.1656	1.1439	0.3660
Knowledge management	0.8579	1	0.9814	0.3140
Brand building	0.8742	1.0189	1	0.3200

Note: Consistency ratio: 0.0000; The weight of its impact on "Green innovation ability of science and technology parks": 0.18.

Table 13. The judgment matrix after the assembly—Green innovation ability of science and technology parks.

Infrastructure Innovation	Park Infrastructure, Transportation Facilities	Park Function	Wi
Park infrastructure, transportation facilities	1	1	0.5000
Park function	1	1	0.5000

Note: Consistency ratio: 0.0000; The weight of its impact on "Green innovation ability of science and technology parks": 0.19.

The algorithm operation mode of the above data is as follows:

Set U to the collection of comprehensive evaluation indicators of innovation ability of science and technology parks, $U = u_1, u_2, u_3, u_4, u_5$, where u_1, u_2, u_3, u_4, u_5 are the first-level evaluation index sets of the innovation ability of science and technology parks, including $u_1 = u_{11}, u_{12}$ as the two characteristic elements under the dimension of industrial innovation; and $u_2 = u_{21}$ as a characteristic element under the innovation degree of business incubator; $u_3 = u_{31}$ for the policy innovation u_3A characteristic element under the dimension; $u_4 = u_{41}, u_{42}, u_{43}$ for the three characteristic elements under the innovation dimension of knowledge management and brand building; finally $u_5 = u_{51}, u_{52}$ for the two characteristic elements under the connotation quality dimension, W is the weight of the first-level index relative to U, and w is the weight of the second-level index relative to the first-level index u. The specific set of evaluation elements is shown in **Table 14**:

(2) Establish a set of comments

According to the standard evaluation steps of the fuzzy multiple decision method, the author sets the college students who distinguish the innovation ability in science and technology parks as "excellent (v_1), a little better (v_2), common (v_3), poor (v_4), weak (v_5)", that is, the judgment set is $V = v_1, v_2, v_3, v_4, v_5$

Table 14. Collection table of level indicators (including weights) of comprehensive evaluation of innovation ability of science and technology parks.

Collection Name	Level Indicators	Weight	Weight	Evaluation Content	Value
Comprehensive evaluation index system of innovation ability of science and technology park U	Industrial innovation u_1	0.28	0.15	New materials industry, new energy industry, new technology industry and other emerging industries	1–5 points
			0.12	Leaders in innovative cultural construction activities, innovative personnel teams, and innovative scientific and technological talents	1–5 points
	Business incubator construction and innovation u_2	0.22	0.22	Innovation in sole proprietorship construction, cooperative operation innovation, guarantee operation innovation, loan support, stock listing support innovation	1–5 points
	Policy innovation u_3	0.17	0.17	Transformation and innovation of government functions, transparency innovation of government performance, financial, tax, fiscal and industrial policies support innovation, innovation of science and technology venture capital funds	1–5 points
	Knowledge management and brand building innovation u_4	0.17	0.06	Managers understanding level of innovation and the positioning level of managers innovation goals	1–5 points
			0.05	Merchants association, innovative culture salon, scientific research cooperation activities	1–5 points
			0.05	Park spirit, service quality, investment promotion activities innovation, property management service innovation	1–5 points
	Infrastructure innovation u_5	0.17	0.08	Special-purpose expressway construction and innovation, logistics service construction and innovation	1–5 points
			0.08	Production agglomeration function innovation, technology incubation function innovation, supporting service function innovation, life and entertainment function innovation, trade and exhibition function innovation, ecological tourism function innovation	1–5 points

Note: Consistency ratio: 0.00.
Source: This article research.
Note: The full score of quantitative score is 5 points, and the worst is 1 point.

(3) Questionnaire survey

Through the development of targeted questionnaires, experts and related people to provide comments data each evaluated science and technology park.

(4) Statistical survey data

The author classified and summarized the questionnaire data, and obtained the comments of all parties.

(5) Build the index evaluation set

According to the set of comments obtained from the survey, the membership of the corresponding index of each evaluated park is calculated. The calculation method is the number of corresponding evaluation levels of the evaluation index divided by the total number of participants in the survey, so as to obtain the corresponding single-factor evaluation matrix and set u_1, u_2, and the corresponding fuzzy relationship matrix under u_3 as r_1,r_2, r_3, respectively.

(6) Synthesis of fuzzy multivariate decision result vector

Let B be the final result vector of fuzzy multiple decision U in science and technology parks, with b_1, b_2, b_3, corresponding to u_1, u_2, and the resulting vector under the u_3 set, and R as the fuzzy relation matrix of the first-level index of the three resulting vector synthesis evaluation systems, according to the fuzzy multivariate decision synthesis rule B = WR.

Due to the numerous elements in the innovation ability index system of the evaluated science and technology park, the weight allocation is relatively balanced. In order to highlight the contribution of each factor to the evaluation, this paper adopts "M (,), weighted average type operator", namely ordinary matrix multiplication to obtain the fuzzy multivariate decision result vector

(7) The evaluation results are obtained

According to the principle of maximum membership, in the fuzzy multivariate decision result vector, the comment corresponding to the maximum value is the comprehensive comment of the evaluated person.

This chapter first analyzed the operating environment of science and technology parks and the main characteristics of their green innovation ability, and then combined with a series of decision analysis methods such as literature analysis and expert group methods, constructed the comprehensive evaluation index system of science and technology park innovation ability, and finally established the AHP-Fuzzy analysis decision model to complete the evaluation of the index system.

3.2. Weight Assignment of First-Level Indicators in the Evaluation of Green Innovation Ability Index of Science and Technology Parks

According to the analysis of **Table 2** series, the main strategic factors to realize the sustainable development of

science and technology parks into innovation capacity construction can be summarized as five first-level indicators, namely: industrial innovation factors, and business incubator construction innovation factors, policy innovation factors, infrastructure innovation factors, knowledge management and brand building innovation factors; 5 first-level indicators are subdivided into 9 second-level indicators and 35 project-level indicators. According to the ranking of the influence degree of the 10 factors in **Table 1** and the empirical data of the 9 indicators at the third level (i.e., the scheme layer) in **Figure 1**, the weights of the 5 first-level indicators are respectively: 0.26, 0.21, 0.18, 0.18, 0.18. For simple evaluation and modeling, if the secondary indicators described in **Figure 2** are taken as the scheme layer, experts are invited to simplify the quantitative weight value and scoring value areas of the influence of the five first-level indicators according to **Table 15**:

Table 15. Quantitative evaluation and weight of the main factors of the first-level indicators of the green innovation ability evaluation in science and technology parks.

Name of Index	Quantification of Weight Values	Value
Industrial innovation	0.26	1–5 points
Business incubator construction and innovation	0.21	1–5 points
Policy innovation	0.18	1–5 points
Knowledge management and brand building innovation	0.18	1–5 points
Infrastructure innovation	0.18	1–5 points

Note: The full score of the quantitative score level is 5 points, and the worst score is 1 point. Consistency ratio: 0.00.

Then, the lowest total score of the innovation ability index evaluation is 0.26×1 + 0.21×1 + 0.18×1 + 0.18×1 + 0.18×1 = 1.0

The highest total score of the innovation ability index evaluation was 0.26×5 + 0.21×5 + 0.18×5 + 0.18×5 + 0.18×5 = 5.0

According to the five-level innovation index:

The highest-level innovation index was 5.0;

The secondary innovation index was 4.0;

The general-level innovation index is 3.0;

The lower-level innovation index was 2.0;

The worst-case innovation index was 1.0.

Theoretically, the technological and economic innovation index of the innovation ability of science and technology parks must reach the weighted average. 5.0 is excellent green innovation ability; 4.0 is better green innovation ability; 3.0 is general green innovation ability; 2.0 is slightly worse green innovation ability; below 1.0 is the worst green innovation ability.

3.3. First-Level, Second-Level Subdivision Indicators of the Green Innovation Ability Index Evaluation of Science and Technology Parks

First and second level indicators, their weight value and evaluation content are presented in **Table 16**.

The three-level indicators in this table are directly scored by the experts as the scheme level indicators, and only used as the quantitative basis for the qualitative evaluation of the score of the upper-level indicators. Then, the minimum total score of the innovation ability index evaluation is 0.1510.1210.2210.1710.0610.0510.0510.0810.081 = 1.0

The highest total score of the Innovation Ability Index evaluation was 0.1550.1250.2250.1750.0610.0550.0550.0850 .085 = 5.0

The actual evaluation index value is between 1 and 5, and the specific classification standard is the same as the above scoring method of 3.2.2 according to the first-level index.

In particular, the above model proposed in this paper has certain time limitations, mainly from the summary of green innovation practices in 15 science and technology parks in the Pearl River Delta, and 6 for the subjective value scores of experts. When establishing the evaluation model of innovation competitiveness in science and technology parks, the selected industrial innovation factors, business incubator construction innovation factors, policy innovation factors, infrastructure innovation factors, and knowledge management and brand building innovation factors are the main variables. As time goes by, their weight relationship may change in the

Table 16. The second-level and third-level subdivision index system of the green innovation ability index evaluation of science and technology parks.

First-Level Indicator (Module) (Weighted Value)	Secondary Indicators (Elements) (Sub-Item Weights Are Empirical Data)	Evaluation Content (Independently Scored by the Expert Group)	Value
Industrial innovation (0.24)	Emerging industries, the "three new" industry innovation (0.14)	New materials industry, new energy industry, new technology industry, and other emerging industries	1–5 points
	Innovation culture And innovative talent (0.11)	Leaders in innovative cultural construction activities, innovative personnel teams, and innovative scientific and technological talents	1–5 points
Business incubator construction and innovation (0.21)	Innovation incubator (0.21)	Sole proprietorship construction innovation, cooperative management innovation, guarantee support innovation, loan support, stock listing support innovation	1–5 points
Government policy and supporting policy innovation (0.18)	Supporting policies for government services and fiscal and financial support (0.18)	Innovation of government function transformation and transparency of government performance; finance, taxation, finance and industry policies support innovation, and innovation of science and technology venture capital fund	1–5 points
Knowledge management and brand building innovation (0.18)	Consciousness of innovation (0.07)	Managers understanding level of innovation and their positioning level of their innovation goals	1–5 points
	Knowledge management innovation (0.06)	Special expressway construction innovation, logistics service construction innovation	1–5 points
	Brand building innovation (0.06)	Production agglomeration function innovation, technology incubation function innovation, supporting service function innovation, life and entertainment function innovation	1–5 points
Infrastructure innovation (0.18)	Hardware facilities in the park Innovation of transportation facilities (0.09)	Merchants association, innovative culture salon, scientific research cooperation activities	1–5 points
	Park function innovation (0.09)	Park spirit, service quality, investment promotion activities innovation, property management service innovation	1–5 points

The score is quantified by the expert group (arithmetic average is calculated, the full score of the grade is 5 points, and the worst is 1 point).

following ways. These changes should be taken into account when building the model.

4. Construction Measures of Green Innovation Capacity in Science and Technology Parks Based on AHP-Fuzzy MSH Model Evaluation

The research found that among the first-level indicators, "industrial innovation", "incubator innovation" and "policy innovation" ranked among the top three key factors. And among the second-level indicators, the three factors of "enterprise incubator innovation", "government policies and fiscal and financial policies" and "the development of new industries and emerging industries" have a significant impact on the innovation capabilities of science and technology parks. Composition chart of green innovation capacity of science and technology parks is presented in **Figure 3**.

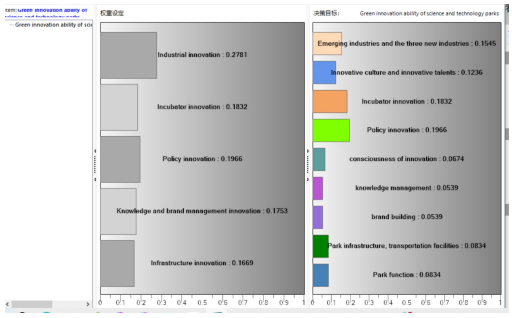

Figure 3. Composition chart of green innovation capacity of science and technology parks.

The strategic measures to improve the green innovation capacity of science and technology parks are as follows:

1. Industrial development and innovation aspects

- Develop emerging industries: Take the path of innovative economic development, focus on the "three new" (new technology, new materials, new energy) industries, and form an industrial cluster development circle with the park as the core through the "three new" industrial chain.
- Build ecological industrial chain: guide enterprises in the park to establish cooperative relations, build ecological industrial chain through resource sharing, waste exchange and other ways, realize the efficient and recycling of resources, and improve the economic and environmental benefits of enterprises.
- Introduce and cultivate leading enterprises to achieve scientific and technological breakthroughs and upgrade the industrial value chain.
- Focus on green industry: clarify the direction of green industry according to the local industrial foundation and resource advantages, introduce and cultivate relevant enterprises. For example, attract upstream and downstream enterprises from the industrial chain to form industrial clusters, and build characteristic parks according to the actual situation.

2. Business incubator construction aspect

- Promote industry-university-research cooperation:

strengthen cooperation with universities and scientific research institutions, build cooperation platforms, jointly carry out green technology research and innovation, promote the transformation and application of achievements, and provide technical support for the green development of the park, such as the practice of Guangzhou Sino-Singapore Knowledge City.

- Cultivating innovative enterprises: to create a good development environment for innovation-oriented enterprises, provide policy support, set up innovation funds, business incubation bases, etc., to help solve the problems of capital, technology and talents, and cultivate enterprises with core competitiveness.

3. Policy innovation aspect

- Property rights and institutional reform: implement property rights reform and seek institutional innovation vitality.
- Talent introduction policy: special affairs for the introduction of high-end talents, at the cost of money.
- Strengthen policy support: The government will formulate and improve policies and regulations, introduce preferential policies such as tax, land and financial subsidies to encourage and support the green development of the park, and strengthen environmental supervision.

4. Knowledge management and innovation culture construction

Promote the construction of knowledge management and innovation culture in the park, build a strong industrial cluster brand, and enhance the ability to attract investment.

5. Infrastructure innovation aspects

- Park planning and design integrate green ecological elements: Park planning focuses on retaining the natural landscape, increasing the greening rate, building ecological parks and other green spaces, and improving the attractiveness and livability, which can be realized by planning green space and creating ecological landscape.
- Adopt green building design: Introduce green building technology, optimize the building design to reduce energy consumption, such as the installation of solar photovoltaic panels, using thermal insulation materials, etc.
- Water resources recycling in the park: learn from the relevant reclaimed water and rainwater reuse treatment system in the park, establish and improve the recycling system, collect and treat rainwater and reclaimed water for non-drinking water purposes, and ensure the quality of recycling water.
- Comprehensive energy management in the park: establish an intelligent energy management system, monitor and regulate energy consumption in real time, rationally allocate energy, and develop and utilize a variety of energy sources to achieve diversified supply and efficient utilization.
- Waste treatment and recycling: learn related industrial base mode, establish classification and recycling treatment system, classify and collect waste, do a good job in recyclable reuse and safe treatment of hazardous wastes.
- Create a green cultural atmosphere in the park: publicize the concept of green development, carry out environmental protection activities, enhance the personnel's awareness of environmental protection and green development, and create a strong atmosphere.
- Improve the functions of the park: - Green ecological elements are incorporated into the planning and design of the park.
- Green building design is adopted.
- Integrated energy management in the park:
- Waste disposal and recycling.
- The park creates a green cultural atmosphere.
- Improve the functions of the park.

5. Application Case Analysis of the Green Innovation Ability Model in Science and Technology Parks

Under sustainable development, the innovation problem of the innovation capacity construction of science and technology parks has been valued by many administrative authorities of science and technology parks. Various science and technology parks are looking for relevant development models and paths, and some innovators take the lead in finding a road to success.

The following is the case of innovation capacity construction, innovation and index evaluation of a private sci-

ence and technology park in the southwest suburb of Foshan City, Guangdong Province under the condition of sustainable development:

Case: A Logistics Park in Dongguan

1. Main Green Innovation Measures Implemented

- Industrial Innovation

  Innovation in Multimodal Transport: Integrate the transportation resources of highways, railways and waterways to create a "highway-railway-waterway" multimodal transport system. With the help of big data and the Internet of Things, optimize the processes to reduce costs, improve efficiency, and decrease energy consumption and pollution.

  Innovation in Green Warehousing Technology: Promote automated three-dimensional warehouses and intelligent warehousing systems, adopt energy-saving equipment and efficient storage management models to reduce energy waste.

- Enterprise Incubator Innovation

  Green Logistics Enterprise Incubation Platform: Provide one-stop services for relevant enterprises, help start-up enterprises develop and promote the application of new energy logistics vehicles.

  Incubation Mechanism of Industry-University-Research Cooperation: Cooperate with universities and scientific research institutions to facilitate the transformation of scientific research achievements and promote the innovation of green logistics technologies.

- Policy Innovation

  Green Subsidy Policy: Provide subsidies and tax incentives to enterprises that adopt new energy vehicles and build green warehousing facilities.

  Planning and Guidance Policy: Position the park as a green logistics demonstration park, ensure the supply of land and guide the industrial upgrading.

- Knowledge and Brand Management Innovation

  In terms of Brand: Shape a unified image, conduct multi-channel publicity and build a service brand.

  In terms of Knowledge Management: Build a sharing platform, organize training activities and create an innovative culture.

- Infrastructure Innovation

  Green Energy Infrastructure: Construct solar photovoltaic power generation facilities, charging pile networks and intelligent management systems.

  Ecological and Environmental Protection Infrastructure: Create ecological landscapes and rainwater collection systems to improve the utilization efficiency of water resources, beautify and protect the environment.

- Main Achievements

The achievements are as follows:

1. Economic Development

- Promotion of Industrial Upgrading: The park has promoted the transformation and upgrading of industries with a focus on green and low-carbon. It has introduced a number of leading enterprises in the industry at home and abroad, such as Huawei Machine and ATL, and formed three industrial clusters in biomedicine, intelligent manufacturing, and new materials, thus promoting the high-quality development of the regional economy.
- Improvement of Logistics Efficiency: For example, the Songshan Lake Warehouse and Distribution Center of Dongguan Post was rated as the only first-class warehouse of China Post in Guangdong Province. Its self-developed semi-automatic package assembly equipment and system have greatly improved the efficiency of logistics warehousing and distribution operations. The current-frequency mails can be processed within 4 hours, the error rate is controlled within one ten-thousandth, the inventory accuracy rate reaches 99.99%, and package assembly and direct transportation to 170 cities across the country have been achieved.

2. Environmental Benefits

- Selection as a "Zero-Waste Park": In 2024, the Songshan Lake High-tech Industrial Development Zone was successfully selected as a typical case of the national "Zero-Waste Park". The solid waste generation intensity had dropped to 0.019 tons per 10,000 yuan in 2022, far below the average level of Dongguan City.
- Optimization of Energy Structure: The distributed photovoltaic power generation projects in Taike Industrial Park and the factory areas of small and medium-sized enterprises have filled the gap in green power in the park and reduced the emissions of air pollutants

such as carbon dioxide and sulfur dioxide.

3. Social Benefits

- Increase in Employment Opportunities: Enterprises in the park have provided a large number of job positions covering multiple fields such as logistics, e-commerce, and manufacturing, which has promoted the employment and income increase of local residents.
- Driving the Development of Surrounding Areas: The development of Songshan Lake Logistics Park has driven the economic development of surrounding areas, promoted the urbanization process of the region, and improved the infrastructure level and public service level of surrounding areas.

4. Innovation Development

- Remarkable Achievements in Enterprise Incubation: The enterprise incubator in the park has provided a good development environment for green logistics-related enterprises, promoting the innovation and application of green logistics technologies and services such as the leasing of new energy logistics vehicles and intelligent warehousing systems.
- Technological Innovation Driving Development: Enterprises in the park have actively carried out technological innovation activities. The application of green logistics technologies such as automated three-dimensional warehouses, intelligent warehousing systems, and multimodal transport has improved logistics efficiency, reduced logistics costs, and enhanced the competitiveness of the park.
- Strengthening of Environmental Access: The park has implemented a strict environmental access system, issued relevant documents to regulate the examination and approval work of the environmental impact assessment of construction projects that generate solid waste, strictly controlled "high energy consumption, high pollution and low efficiency" projects, and reduced the growth rate of industrial solid waste.
- Improvement of Management Model: A whole-chain solid waste management model has been constructed. Activities such as the creation of "Zero-Waste Cells" have been carried out in the three major fields of industry, life, and construction to improve the standardized management level of hazardous waste in the park and provide a reference for the green development of industrial parks across the country.

At present, the private science and technology park has initially formed a high-tech industry cluster area with electronic information, auto parts, biopharmaceutical, health industry, new materials and environmental protection technology as the leading industries. The growth strategy of the private science and technology industry base has achieved successful innovation, and the second entrepreneurial goal has been realized.

According to the innovation ability evaluation index system based on AHP-Fuzzy, the following is requested to test and evaluate the successful experience of the park from five aspects: industrial innovation, business incubator construction, government policy, infrastructure construction and brand development. The first and second level indicators, evaluation content, and their respective values are presented in **Table 17**.

According to the data in **Tables 1–5**, the weighted score value of the green innovation ability evaluation of the science and technology park is (4.2*0.15) +(3.9*0.12)+(4.2*0.22),+(4.5*0.17)+(4.0*0.06)+(4.0*0.05)+ (4.0*0.05)+(4.5*0.08)+(4.1*0.0.08) = 4.115.

The innovation index of the innovation capacity of the technology park is 4.115, and the performance reaches a good level, but there is still potential to be tapped.

In this case, the science and technology park construction enterprise is consciously or unconsciously implementing the sustainable development requirements, a series of technical and economic innovation modes, measures more proper, comprehensive score to good innovation and degree, the results not only obtained the sustainable development, environmental protection, technology innovation and sustainable development, and also achieved good economic benefits, realize the output tax growth, growth strategy construction transformation effect is outstanding.

The improvement of the growth indicators of Foshan Private Science and Technology Park cannot be solely attributed to green innovation. External economic factors also play an important role.

From the perspective of green innovation, it serves as the internal driving force for growth. For example, by adopting advanced green production technologies, the enterprises in the park have reduced pollution emissions, improved re-

Table 17. The second-level and third-level subdivision index system of the green innovation ability index evaluation of science and technology parks.

First-Level Indicator (Module) (Weighted Value)	Secondary Indicators (Elements) (Sub-Item Weights Are Empirical Data)	Evaluation Content (Independently Scored by the Expert Group)	Value
Industrial innovation (0.26)	Emerging industries, the "three ne" industry innovation (0.14)	New materials industry, new energy industry, new technology industry, and other emerging industries	4.2
	Innovation culture And innovative talent (0.11)	Leaders in innovative cultural construction activities, innovative personnel teams, and innovative scientific and technological talents	3.9
Business incubator construction and innovation (0.21)	Innovation incubator (0.21)	Sole proprietorship construction innovation, cooperative management innovation, guarantee support innovation, loan support, stock listing support innovation	4.2
Policy innovation (0.18)	Supporting policies for government services and fiscal and financial support (0.18)	Innovation of government function transformation and transparency of government performance; finance, taxation, finance and industry policies support innovation, and innovation of science and technology venture capital fund	4.5
Knowledge management and brand building innovation (0.18)	consciousness of innovation (0.07)	Managers understanding level of innovation and positioning level of innovation goals	4.0
	Knowledge management innovation (0.06)	Special expressway construction innovation, logistics service construction innovation Business and exhibition function innovation, ecological tourism function innovation	4.0
	Brand building innovation (0.06)	Production agglomeration function innovation, technology incubation function innovation, supporting service function innovation, life and entertainment function innovation	4.0
Infrastructure innovation (0.18)	Hardware facilities in the park Innovation of transportation facilities (0.09)	Merchants association, innovative culture salon, scientific research cooperation activities	4.5
	Park function innovation (0.09)	Park spirit, service quality, investment promotion activities innovation, property management service innovation	4.1

Note: The score is quantified by the expert group (arithmetic average is calculated, the full score of the grade is 5 points, and the worst is 1 point).

source utilization rates and cut production costs simultaneously, making their products more competitive in the market and thus facilitating the growth of industrial output value. Meanwhile, the new products and services brought by green innovation have also met the market's demand for environmentally friendly products and expanded the market share.

External economic factors have also made significant contributions. In terms of the macroeconomic environment, the expansion of domestic market demand has provided broad sales space for the enterprises in the park. In terms of policies, the government's support policies for private science and technology parks, such as tax incentives, preferential land use and scientific research subsidies, help the enterprises in the park increase their R&D investment and expand their production scale. Moreover, Foshan has a superior geographical location and convenient transportation, which is beneficial to the procurement of raw materials and the transportation of products for the enterprises in the park and reduces logistics costs. These external factors jointly promote the growth of the industrial output value of the park. However, this case is cited in this study because its systematic green innovation measures are quite in line with the central viewpoint of this article and have the function of practical proof.

6. Conclusions

Under the condition of sustainable development, the mode innovation of innovation capacity construction of science and technology parks is a social and economic activity with difficulties, technical challenges and extensive involvement. Joint actions require the participation of the government, enterprises, society, scientific research institutions and institutions of higher learning. This paper proposes and discusses the evaluation modes and methods of green innovation ability of science and technology parks based on AHP-Fuzzy evaluation. On this basis, it puts forward the construction of green innovation capacity of science and technology parks, which can provide theoretical reference for the practical activities of the development of science and technology parks. However, the construction and management of green innovation ability in science and technology park is a complex systematic engineering. This paper is only a preliminary exploration to study the general law of market competition and the technical and economic growth and innovation mode of the development of the industry. There are many problems, such as the limited factors to overcome methods for building science and technology park innovation ability, the principal-agent condition of the incentive evolution of the social dynamic mechanism in science and technology park innovation ability of construction, the property rights constraints of science and technology park innovation ability,

the stakeholders management of science and technology park innovation ability, and the innovation culture and brand development strategy of science and technology park innovation ability, which has yet to be further researched and discussed.

Author Contributions

H.X.: Conceptualization,methodology,writing—original draft preparation,software, validation and formal analysis; X.-y.Y.: investigation, resources, writing—review and editing,funding acquisition,supervision,project administration; W.Z.: data curation, visualization. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement

This studies not involving humans.

Data Availability Statement

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Conflicts of Interest

None of our authors have undisclosed conflicts of interest.

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