

Study on the Index System of Green Ecological Building and Its Evaluation

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Abstract: Based on the concept of sustainable development, green and ecology has become a hot topic in the development and research of many industries. It is not only a new culture, but also that art, technology, material and so on will change under the guidance of this kind of thought. Architecture is the main body of the city, and it also is the necessary component of the human survival and social developments, the basic function of the building is to provide people with living space. With the development of society, the architectural function is constantly enriched, the structure tends to be complicated, but the influence of its own problems is also expanding. The development of the construction industry requires a lot of resources, and in the process of using its function and it needs other energy to provide its due support, because in the past we only consider the building function, ignoring the energy and information consumption. Considering the current social development, we have to take the energy and resource issues into account, based on this condition, the green eco-building concept and technical standards is producing, and it changed people's views on social development. Green eco-buildings also need to have indicators as a reference, while providing guidance of architectural design and construction. This paper gives a brief exposition of the research system of green ecological architecture and its evaluation.

1. Introduction

Green ecological building has great significance of the promotion of social progress, improving the living environment of human society, improving the standard of living, It is an important means to achieve sustainable development. The promotion and application of green ecological building needs to provide a set of perfect standards and system to support it. Green ecological architecture of different levels has different meaning, in the technical level, it can combine with other technologies, the editorial level, it advocates green lifestyle, from the macro and micro aspects of the two sides to analyze, the former can effectively solve the energy problem, the latter can provide specific guidance and basis for the construction work, from the environmental level it can improve the quality of the environment, to achieve the harmony between the human and social development.

2. Green ecological building

Green ecological building means that in the life cycle of the building, the construction play the normal function at the same time it can maximize the conservation of resources or energy, reduce the damage to the environment, so as to achieve the harmony between man and nature. Green buildings can also be called ecological buildings. The connotation of green ecological building can be understood from four aspects: resource and energy conservation, the social development is the cost of resource and energy consumption, but the number of resources and energy is limited, taking the future development into account, they need rational use. Second is the environmental protection, in the past we only pursue social and economic development, while ignoring the environmental problems, the premise of



human social development is environmental development, when there is a problem of the natural environment, there will be a problem of human society development. The third is to provide a safe, comfortable and healthy living space. Fourth is the harmony between the social development and the natural environment, harmonious development, scientific development, sustainable development.

Based on the principle of sustainable development green ecological building to achieve the harmony between people, buildings, the environment, through scientific and rational settings, natural lighting, low energy consumption, new energy use, new materials, intelligent technology and other comprehensive use, It not only taking human needs into account, but also taking into account environmental issues. The significance of vigorously promotes and apply green ecological building is to save resources and protect the environment. From the macroscopic level, it is the embodiment of the scientific concept of development, which is the need of industrial restructuring and economic development. It is the need to promote the construction of resource-saving and environment-friendly society. It is also one of the way of ecological civilization construction in order to promote innovation and develop industry. From the micro level, green ecological building can provide a good living environment, improve the quality of life.

3. The index system of the green ecological building evaluation

3.1. The principle to establish the system

The principle of scientific is one of the important principles of system establishment. Based on the practical application of theoretical knowledge to get the corresponding indicators, the emphasis is the combination of theory and practical work, to avoid subjective qualitative indicators. The establishment of evaluation system should be scientific and fair, clear indicators of the extension and concept, to avoid overlap, the indicators should be clear, to avoid ambiguity. Evaluation system is composed of different indicators, with a certain level of structure, in the design of the green building the index system is able to reflect the various aspects. In the hierarchical structure, different indicators represent the affiliation with the evaluation indicators, and then the internal indicators of the system for longitudinal or horizontal analysis, in order to analyze the level of building energy consumption. Indicators must be used in determining certainty and ensure that they are operational.

For the indicators within the system they can be divided into two categories, qualitative and quantitative indicators, quantitative indicators is used to quantify and thus it can better applied to the green building evaluation system. Specificity and universality, the evaluation system should be taken into account when considering the special aspects, but also take into account the common aspects, reflected on the index is a special indicator and the general indicators. For specific indicators, the analytical work needs to take the relationship of other indicators into account. Finally, we need to consider the principle of dynamic orientation, based on the concept of dynamic development of the transaction, the evaluation system indicators continue to improve.

3.2. Green Ecological Building Evaluation System

The construction of evaluation system is the key to promote the sustainable development of green building and it also is an important aspect of research work. The evaluation system includes environmental evaluation system, energy and environment design evaluation system, and sustainable development quality certification system. The environmental evaluation system is the first green building evaluation system to be used in the market and government management works in the world, and it has been tested for a large number of practices, so its application is more extensive. The scope of application of the environmental evaluation system includes office buildings. With the development of the society and the requirements of the building itself, the scope of application is gradually extended to various types of buildings. The evaluation contains including transportation, materials, energy, management, pollution, water resources, ecological value, land to use, physical and mental health, and so on, and they were classified as global, local, indoor environmental through its ' impact performance categories. The advantages of the evaluation method are based on the whole life cycle

method and the theoretical system. Through the practice study, the relationship between environment and architecture is explored, namely, interaction and influence, and the efforts are made to balance and coordinate them. Emphasizing the relativity of green buildings, which provides data to support it, and designers can use data analysis to determine the rationality of the design. But the downside is that the method is more complex.

Energy and environment design pioneer design system, the system is widely used through six categories of evaluation of the building, and each classification will have sub-classification and the corresponding standard [1]. Sustainable construction quality certification system, the system also consists of six categories of indicators, and contains a number of sub-evaluation criteria.

3.3. Green building evaluation method

The evaluation method is the basis of the evaluation of green building. By means of the evaluation method, the green building evaluation method is selected according to the characteristics of the comprehensive evaluation of the building through the comprehensive comparative analysis and the characteristics of the life cycle assessment and the overall environmental evaluation. In the early evaluation method mainly depends on the expert experience and knowledge to determine, the determination has strong subjective color, the evaluation results are not objective, the advantages of the operation is very convenient to apply. However, the green building evaluation work is complex, dynamic and hierarchical. To ensure the objective and scientific nature of the evaluation work, it is necessary to achieve the effect of various evaluation methods. Some commonly used evaluation methods include AHP, gray comprehensive evaluation, comprehensive fuzzy evaluation, gray fuzzy combination evaluation, fuzzy analytic hierarchy process and so on.

The level analysis method was originally used to solve the economic problems, mainly the program selection and comparison, divided the decision-making indicators into different levels, through the combination of qualitative and quantitative decision-making analysis. The method includes analyzing the problem, constructing the model, analyzing and comparing the preference relation, establishing the relation matrix, establishing the index weight through a series of links, and then carrying out the comprehensive evaluation, and selecting the optimal scheme according to the result. The fuzzy comprehensive evaluation method is to replace the explicit set through the fuzzy set, so as to describe the uncertainty system, and its purpose is to analyze the fuzzy system. The method is widely used in engineering field. Gray comprehensive evaluation method uses the quantitative analysis method to describe the gray system, so that the evaluation of the subjectivity can be reduced. This method can be used to identify and recognize the uncertainty system by means of known information. The objective of the system evaluation is to be enhanced, but the application of this method has certain requirements for the uncertainty system.

Gray fuzzy combination assessment method, this method is the gray theory into the fuzzy comprehensive evaluation, the fuzzy method has improved a lot, and then evaluate the project based on its steps and processes. When using this method, the system has certain requirements, such as the data should be relatively complete, the qualitative and quantitative means combined together, the improved method to a certain extent, enhance the comprehensive evaluation method of objectivity and scientific. Fuzzy AHP method, which belongs to the category of combination analysis method, and uses the analytic hierarchy processed to calculate the system index. The evaluation adopts the comprehensive fuzzy evaluation method. This method improves the quality and effect of the cognition of the uncertainty system. The quality and level of the problem decision-making are also improved. The authenticity of the decision-making result is enhanced, and the advantages of the two methods are combined. When the single method are applied, the conditions have been expanded, the method has also been improved [2].

3.4. Green evaluation method selection

The establishment of green building index system is relatively complex. When the index system is set, it has the characteristics of uncertainty, and it is usually difficult to carry out the work by using

comprehensive evaluation. The establishment of the evaluation indexes system, according to the relevant principles and methods to establish a preliminary index system, and through other methods of application of removed the redundant indicators, so that the index system is more scientific and reasonable, to lay the foundation for the evaluation work. In the aspect of the evaluation method, due to the complexity, the hierarchical and the dynamic characteristics of the green building evaluation system, the index data acquisition has some difficulty, and the problem can be solved by fuzzy AHP method and other methods to the green index system evaluation, so as to enhance the scientific results of the evaluation results.

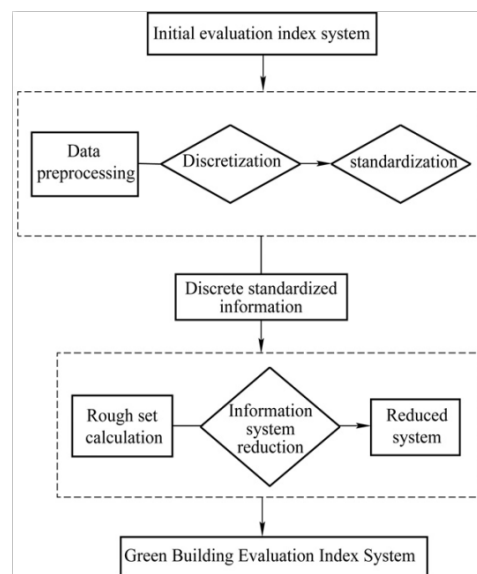
4. Construction of Green Evaluation Index System

4.1. Evaluation index system was established

According to the principle of green index system and the establishment of ideas, and learn from the results of other systems research work, combined with the characteristics of green building development and focus to architectural evaluation as a primary indicator, on the basis of its subdivision, generate the specific indicators, as the picture shows.

After the initial establishment of the evaluation system index, in order to improve the quality of the evaluation work, it is necessary to perfect the system index, and use the mathematical method to remove the repetitive indicators with strong correlation so that it can be operable and the evaluation index system as shown.

Target layer	Criteria layer	Index layer
Green building evaluation content	Resource consumption	Materials and energy use
		Land use
		Water use
		Atmospheric pollution
		water pollution
	Environmental load	light pollution
		sound pollution
		Solid waste treatment
		Indoor and outdoor air quality
	Indoor and outdoor environmental quality	Indoor and outdoor thermal environment
		Indoor and outdoor light environment
		Indoor and outdoor sound environment



Evaluation system reduction process

The main method of the reduction of the evaluation system are the application of the rough set theory and the continuous improvement. The experts on the evaluation field are based on the comparative analysis, the indexes are graded, and the data are standardized by the relevant software, and the evaluation index system to streamline, the formation of the final evaluation system indicators. The expert group are determined to be the prerequisite for the establishment of the evaluation system. The composition of the expert group takes into account the educational background, knowledge structure, work experience, age structure, quantity and so on. In ensuring the quality of the premise to maximize the coverage, experts should have a certain work experience. Data processing using clustering method of data discretization, standardization processing is done through software[3]. In the use of software processing may have some defects, sorting can not be based on the meaning of economic indicators, need the classification which is based on the specific meaning of the classification of the data after the definition. The data definition is divided into three types, good, medium and poor, and then the data is normalized to get the clustering results. Standardize the evaluation index data, and obtain the standardized data table

5. Comprehensive evaluation of green building

In order to ensure the effectiveness and quality of the evaluation results, we should take into account the application scope and conditions of the method, and combine the characteristics of the evaluation system to select the method. The method of determining the weight of the evaluation system is that the hierarchical structure is constructed and classified as the highest level, the middle layer and the lowest level. Fuzzy preference relation construction, hierarchical ranking of weight index, consistency test. For example, the use of comprehensive fuzzy evaluation method, the first set of factor set, after the establishment of evaluation set, and finally evaluation.

A	B1	B2	B3	W	C. I.	R. I.
B1	1	7/9	9/5	0.33		
B2	9/7	1	7/3	0.46	0.002	0.52
B3	5/9	3/7	1	0.21		

The criterion layer is constructed by the matrix at the time of construction to obtain a single row order.

Concluding remarks

The establishment of green building evaluation system can promote the orderly and healthy development of green building, also plays an important role in social development. Green building

evaluation system research has become a hot spot, and the research work has achieved some results. With the increasing of energy problems and environmental problems in recent years, the degree of concern about the green problem has been improved obviously. Through its in-depth study and analysis, both in theory and in the method system are more perfect than in the past. Development goals to lay the foundation. Green building in China's development time is relatively short, should be clearly aware of the current work of the problems, such as the need for sound index system, evaluation methods need to be further optimized. With the people's deepening of the green concept understanding, green building applications and promotion will inevitably have a huge ecological and social benefits.

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