Exploration of Architectural Space Design Guided by Ecological Civilization Concept

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Abstract: This article discusses the architectural space design under the guidance of the concept of ecological civilization. At present, the ecological environment problem is outstanding, which is the key to the transformation of the construction industry. Under this background, the article deeply analyzes the relevant theoretical basis, combs the connotation of ecological civilization concept and related theories such as ecological architecture and sustainable development; This article analyzes the present situation of architectural space design, and reveals the existing problems of integrating ecological civilization concepts such as insufficient concept cognition, limited technology application and imperfect design methods. Furthermore, the design principles of ecological priority, efficient use of resources, people-oriented and overall coordination are put forward, and the design strategies of spatial layout, shape design, material and technology application are given. The research shows that integrating the concept of ecological civilization into all aspects of architectural space design can promote the sustainable development of the construction industry and provide an effective path for creating a green, comfortable and efficient architectural space.

1. Introduction

At the moment when the global ecological and environmental problems are becoming increasingly serious, the construction of ecological civilization has become a key issue for the sustainable development of human society [1]. As an important field of resource consumption and environmental impact, the transformation of its development model is imminent [2]. In this context, integrating the concept of ecological civilization into architectural space design has become the core path to realize the sustainable development of architecture.

The concept of ecological civilization emphasizes the harmonious coexistence between man and nature, and pays attention to the balance and protection of the ecosystem [3]. The rise of this concept has brought a brand-new perspective and challenge to architectural space design [4]. Traditional architectural space design often focuses on meeting functional requirements and beautiful form, and the consideration of ecological environment factors is relatively insufficient [5]. However, with people's increasing attention to ecological environment issues, architectural space design needs to pay more attention to ecology, sustainability and integration with the natural environment on the basis of meeting basic functions [6].

This article focuses on the architectural space design under the guidance of the concept of ecological civilization, aiming at deeply discussing how to implement the concept of ecological civilization in all aspects of architectural space design. By combing and analyzing the relevant theories, this article analyzes the current situation of architectural space design and the problems existing in the process of integrating the concept of ecological civilization, and then puts forward targeted design principles and strategies.

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2. The status quo of architectural space design and the integration of ecological civilization concept

2.1. Analysis of the current situation of architectural space design

The traditional architectural space design mode has long focused on satisfying people's basic living and using functions. In terms of functional layout, we often follow a relatively fixed pattern. For example, in residential design, functional spaces such as bedroom, living room and kitchen are often clearly divided [7]. In terms of spatial form, regular and symmetrical forms are often pursued to meet the needs of aesthetics and structural stability. This design mode ensures the realization of architectural functions to a certain extent, but relatively little consideration is given to ecological factors [8]. With the development of the times, architectural space design presents a diversified modern trend. Functionally, it pays more attention to meeting diverse social needs, such as the emergence of a multi-functional comprehensive building integrating office, residence and leisure [9]. In terms of spatial form, it breaks through the traditional regular pattern and pursues unique and novel shapes to show the personality and vitality of the city. The application of modern science and technology has brought new possibilities for architectural space design. However, although modern design trends have made great innovations in function and form, there are still some problems to be solved urgently in terms of ecological friendliness.。

2.2. The concept of ecological civilization is integrated into the existing problems

At present, in the construction industry, some designers and owners have insufficient understanding of the importance of ecological civilization concept in architectural space design [10]. As for designers, influenced by traditional design education and thinking patterns, some people fail to fully understand the connotation of the concept of ecological civilization, and still focus on function and form in the design process, ignoring ecological factors. Owners often pay more attention to the initial investment and short-term benefits of buildings, and think that integrating the concept of ecological civilization will increase the construction cost, but they lack forward-looking understanding of long-term ecological and social benefits. According to the survey of some relevant personnel of construction projects (see Table 1), about 40% of the designers said that ecological factors were only occasionally considered in the design, while as many as 60% of the owners thought that ecological design would greatly increase the cost and were unwilling to take the initiative.

Table 1: Survey on the Awareness of the Concept of Ecological Civilization among Construction Industry Personnel

Survey Respondent	Level of Attention to the Concept of Ecological Civilization	Percentage of Respondents Who Believe Ecological Design Increases Cost (%)	Frequency of Considering Ecological Factors in Design
Designers	Great attention: 20% More attention: 42% Occasional attention: 40%	-	Often: 30% Occasionally: 41% Rarely: 29%
Owners	Great attention: 11% More attention: 30% Occasional attention: 61%	Substantial increase: 60% Small increase: 32% Basic no increase: 10%	-

There are many limitations in the application of ecological technology in architectural space design. First, the cost is high, such as solar photovoltaic power generation, ground source heat pump and other technologies, and the cost of equipment purchase and installation in the early stage has discouraged many projects. Second, some technologies are immature, and the stability and reliability are not good. Thirdly, the integrated application of ecological technology is facing challenges, and the compatibility and synergy between different technologies need to be optimized to achieve the best ecological benefits.

The existing architectural space design method is insufficient to integrate the concept of ecological civilization. The traditional design process pays attention to function and form first, and

then considers ecology later, so it is difficult to make up for it afterwards. Moreover, it lacks a complete and systematic ecological design method system, and designers lack clear guidance when designing, so it is difficult to fully and deeply integrate the concept into all links.

3. Principles of architectural space design under the guidance of ecological civilization concept

3.1. Ecological priority principle

The principle of ecological priority requires that the protection and restoration of ecological environment should be put in the first place in all aspects of architectural space design. In the site selection stage, priority should be given to sites with less damage to natural ecology, and construction in ecologically sensitive areas such as wetlands and nature reserves should be avoided. In terms of layout, buildings should coordinate with the surrounding natural environment, protect the original topography, landforms and vegetation, and realize the organic integration of architecture and nature.

3.2. The principle of efficient use of resources

The principle of efficient utilization of resources emphasizes that in the design of architectural space, the utilization efficiency of energy, water resources, building materials and other resources should be maximized. In terms of energy utilization, we should make full use of renewable energy such as solar energy and wind energy, and optimize the thermal insulation performance of buildings to reduce building energy consumption. For water resources, the rainwater collection system and reclaimed water reuse system are designed to realize the recycling of water resources. In the selection of building materials, local, renewable and recyclable materials are given priority to reduce energy consumption and environmental impact during material transportation (see Table 2).

Table 2: Statistics on Measures for Efficient Utilization of Construction Resources

Resource Type	Efficient Utilization Measure	Application Rate (%)	Expected Energy or Resource Saving Effect (%)
Energy	Solar Photovoltaic Power Generation System	30	20-30 (Proportion of Electricity Supply)
	Application of High-Efficiency Insulation Materials	60	15-25 (Proportion of Energy Consumption Reduction)
Water Resources	Rainwater Collection System	40	10-20 (Proportion of Non-Potable Water Substitution)
	Reclaimed Water Reuse System	25	15-25 (Proportion of Miscellaneous Water Saving)
Construction Materials	Use of Local Materials	50	10-15 (Proportion of Transportation Energy Consumption Reduction)
	Use of Renewable Materials	35	-

3.3. People-oriented principle

People-oriented principle focuses on meeting people's physiological and psychological needs and creating a comfortable, healthy and pleasant architectural space environment. In terms of physiological needs, ensure that there are suitable temperature, humidity, ventilation and lighting conditions in the building to reduce noise interference. In terms of psychological needs, we should pay attention to the sense of scale, hierarchy and beauty of space and create a warm and comfortable space atmosphere.

3.4. The principle of overall coordination

The principle of overall coordination emphasizes that architectural space design needs to coexist with the surrounding natural environment, urban environment and various functional spaces of the

building to form an organic whole. The coordination between architecture and the surrounding natural environment is to conform to the laws of nature, use natural elements to serve architecture, and reduce the negative impact of architecture on the natural environment. Coordination with the urban environment requires that the building should be in line with the overall urban planning in function and form, so as to promote the sustainable development of the city. Within the building, all functional spaces should be coordinated with each other, and the overall operation efficiency of the building should be improved through reasonable streamline organization and spatial layout.

4. Architectural space design strategy under the guidance of ecological civilization concept

4.1. Spatial layout strategy

The spatial layout of buildings should fully respect the natural topography, landforms and climatic conditions. In mountainous areas, buildings can be arranged randomly according to the terrain to reduce the damage to the mountain, and at the same time, natural ventilation and drainage systems can be formed by using the height difference. For example, some mountain buildings in southwest China are built in line with the mountain situation, which not only complements the surrounding natural landscape, but also achieves good ventilation effect with the help of the terrain. In the hot climate area, the building layout should be open to increase the contact area between the building and natural air and promote natural ventilation. By reasonably planning the spacing and orientation of buildings, buildings can get enough sunshine, avoid excessive exposure in summer and reduce energy consumption of air conditioning and refrigeration.

Optimizing the combination of building functional space can effectively improve the efficiency of space use and energy utilization. Futhermore, the space with similar functions will be arranged in a centralized way, such as setting the offices of relevant departments adjacent to each other in an office building to improve the efficiency of work coordination. For spaces with different energy requirements, reasonable zoning can be carried out, such as centralized layout of spaces with high thermal insulation requirements, which is convenient for unified thermal insulation treatment and reduces energy consumption.

4.2. Spatial form design strategy

By controlling the building shape coefficient, that is, the ratio of the external area of the building to the enclosed volume, the building energy consumption can be effectively adjusted. The smaller the shape coefficient, the better the thermal insulation performance of the building. Therefore, in cold areas, the architectural form should be compact, reduce the external area and reduce heat loss; In hot areas, the surface area of the building can be appropriately increased, which is beneficial to heat dissipation. In addition, it is very important to design the window area and form reasonably. Set a larger window area in the direction of dominant wind in summer, and use natural ventilation to reduce indoor temperature; In winter, the area of north window opening is reduced to avoid heat loss.

Ecological aesthetics emphasizes that architectural form should reflect the beauty of nature and ecological concept. Architectural form can imitate the form and structure of natural creatures, which not only has unique visual effects, but also can realize certain ecological functions. For example, the shape of Sydney Opera House is inspired by shells, and its unique appearance not only shows artistic beauty, but also blends with the surrounding coastal environment. In addition, the use of green plants to decorate and cover the building skin can not only beautify the appearance of the building, but also play an ecological role in heat insulation, noise reduction, air purification, and create a vibrant architectural space form.

4.3. Application strategy of materials and technology

Giving priority to locally produced building materials can reduce carbon emissions and energy consumption during material transportation. For example, local materials such as stone and wood not only have good regional characteristics, but also reduce costs. Futhermore, pay attention to the

renewable and recyclable materials, such as recycled steel and recycled concrete. The energy consumption of these materials in the production process is much lower than that of the original materials, and they can be recycled, which meets the requirements of sustainable development. Selecting materials with good thermal insulation performance, such as thermal insulation rock wool board and vacuum thermal insulation board, can effectively improve the energy-saving effect of buildings.

The best ecological benefits can be achieved by integrating various ecological technologies into architectural space design. For example, solar photovoltaic power generation technology is integrated with building design, and solar panels are installed on the roof or wall of the building to provide some electricity for the building. Combined with ground source heat pump technology, heating in winter and cooling in summer can be realized, and shallow geothermal energy can be used efficiently. Intelligent control system is used to automatically adjust ventilation, lighting, air conditioning and other equipment according to indoor and outdoor environmental parameters, so as to realize intelligent management and efficient utilization of building energy and create a green and low-carbon building space.

5. Conclusions

This article focuses on the application of ecological civilization concept in architectural space design, and has achieved important results through in-depth research in many aspects.

On the theoretical level, it is clear about the concept of ecological civilization and its close connection with the related theories of architectural space design, which lays a solid foundation for the follow-up research. Through the analysis of the present situation, it is found that despite the continuous development of architectural space design in function and form, it is still difficult to integrate the concept of ecological civilization, and problems such as concept cognition, technical application and design methods need to be solved urgently. Based on this, four design principles are put forward. The principle of ecological priority emphasizes the harmonious symbiosis between architecture and nature, the principle of efficient utilization of resources pays attention to all kinds of resource conservation, the principle of people-oriented pays attention to people's needs, and the principle of overall coordination highlights the coordination between architecture and internal and external environment. Futhermore, the design strategy is given from three aspects: spatial layout, shape design, material and technology application, which provides specific guidance for practice. This study is of great significance to the ecological transformation of architectural space design. It not only enriches the theory of architectural design, but also points out the direction for the development of the industry.

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