Carbon Sink Trading Platform Mechanism of PPP Mode of Landscape Architecture Project Based on Carbon Neutralization Concept

Shyng, Jyh Harng*

Department of Landscape Architecture, School of Life Sciences, Zhaoqing University, Zhaoqing, Guangdong, China

Abstract. In the context of globalization and environmental changes caused by climate change, countries have been actively investing in promoting carbon reduction systems. Currently, under the dual carbon policy, achieving carbon neutrality and carbon compliance require different strategies. Among them, for the carbon neutrality goal, the carbon sink function of landscape architecture plays a very important role in the carbon trading platform with the introduction of the PPP model. In this study, the relationship between carbon sink and enterprise carbon trading of PPP mode landscape architecture project. It is found that the carbon trading platform plays a key role in the landscape architecture carbon sink project, reduces greenhouse gas emissions through market-based means, achieves the transaction of carbon emission rights and enterprise investment, and at the same time, for landscape architects, helping achieve carbon neutrality is a very important and urgent responsibility and mission.

1.Introduction

As industrialization accelerates, the issue of global climate change is becoming increasingly severe. Excessive emissions of greenhouse gases, such as carbon dioxide and methane, are causing global temperature rise, which has triggered a series of environmental issues, including sea level rise, frequent extreme weather events, and biodiversity loss. To address this challenge, governments around the world have proposed the goal of carbon neutrality, which aims to achieve a balance between anthropogenic greenhouse gas emissions and removals by sinks by a certain point in time, resulting in net zero emissions. Under the goal of carbon neutrality, how to enhance the carbon sink function of landscape architecture and enable it to play a greater role in climate change is a question worth studying.

2. The carbon sink function of landscape architecture in carbon neutrality literature.

Literature research suggests that landscape architecture, as an ecosystem, has a significant carbon sink function, can absorb carbon dioxide through various ways, and is of great significance for achieving the carbon neutrality goal. To promote landscape architecture carbon sink projects, it is necessary to work together with private social capital. The use of the PPP model can introduce private sector investment and efficiency, improve project efficiency and sustainability.

2.1 Research on International Consensus and Goal of Carbon Neutralization on Climate Change

There are many studies on carbon neutrality of climate change in the world, including: the report of the Panel on Climate Change (IPCC) emphasizes the importance of achieving carbon neutrality and provides guidance on how to reduce greenhouse gas emissions and increase carbon sinks.[1] The United Nations Framework Convention on Climate Change report emphasizes the importance of achieving carbon neutrality and provides guidance on how to reduce greenhouse gas emissions and increase carbon sinks. [2]

The International Energy Agency (IEA) emphasizes the need to take measures in renewable energy, energy efficiency, carbon capture and storage, including technological innovation and policy support. [3] In the case study, Brown, T.A. & Ulrich, K.T. (2022) made a comparative analysis of the energy efficiency policies of 67 countries, emphasizing the measures needed to achieve the goal of carbon neutrality. [4]The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) provides information on the linkages between biodiversity, ecosystem services and human well-being. [5]

2.2 Research on PPP Mode of Carbon Neutral Trading Platform Mechanism

At present, the main platform mechanism of carbon sink is not perfect, but with the progress of technology and the development of market, it is expected to realize more efficient and sustainable carbon sink in the future.[6] China and the United States have made some progress in carbon sink, but there are many differences and challenges. Relevant policies and standards need to be further improved to promote a more sustainable and fair carbon sink.[7]

Although many projects try to achieve the goal of carbon neutrality through carbon sink, there are many problems, such as lack of uniform standards and certification system, and large price fluctuation. Therefore, it is necessary to further improve the mechanism of carbon sink platform in order to achieve a more sustainable and fair carbon sink. [8]

PPP mode can improve the sustainability and efficiency of the project, while reducing risks and costs. Continued and fair carbon sink. [9] It is further proposed that PPP mode can promote the cooperation between the government and the private sector, and jointly promote the realization of the carbon sink and carbon neutrality goals of landscape architecture projects. [9] PPP mode can promote the sustainable development of building environment through public-private cooperation, while reducing costs and risk. PPP mode can promote technological innovation and knowledge sharing and improve the sustainability and efficiency of projects.[10]

2.3 Research on the Method of Achieving Carbon Neutralization in Architecture and Landscape Architecture Industry

In view of the real environmental construction, although the construction industry is the main source of greenhouse gas emissions, the landscape architecture industry is a considerable output source of carbon sinks. If the industry can form a carbon cycle zero emission policy, such as developing cases or institutions, first conducting carbon inventory and then completing its own comprehensive dynamic carbon supervision mechanism, and the legal provisions are incorporated into the relevant norms and renewal of property management for implementation, it is also a concrete measure of carbon neutrality.

On the other hand, in terms of carbon emission management, relevant research still tries to achieve the goal of carbon neutrality in many ways. However, each approach has its advantages and disadvantages and requires a comprehensive consideration of factors such as environmental benefits, costs and social viability. At present, there are five specific ways: (1) by adopting sustainable urban planning measures. [11] (2) Through the adoption of low-carbon technologies and the implementation of carbon offsetting projects. [12] (3) By adopting appropriate landscape design and management measures.[13] (4) By building green infrastructure. [14] (5) By adopting different carbon compensation methods and mechanisms. [15]

3. Operation Mechanism of PPP Mode Carbon Trading Platform in Landscape Architecture Carbon Sink Project

The amount of carbon emissions produced by various carbon sinks included in landscape architectural projects: forest carbon sinks, grassland carbon sinks, cultivated land carbon sinks, soil carbon sinks, and marine carbon sinks.

Landscape architecture projects gather all kinds of carbon sequestration to promote the increment of carbon sinks, and then trade the carbon cycle function and introduce the carbon emission trading platform mechanism. Achieve the goal of zero emission and carbon neutrality. (Figure1)

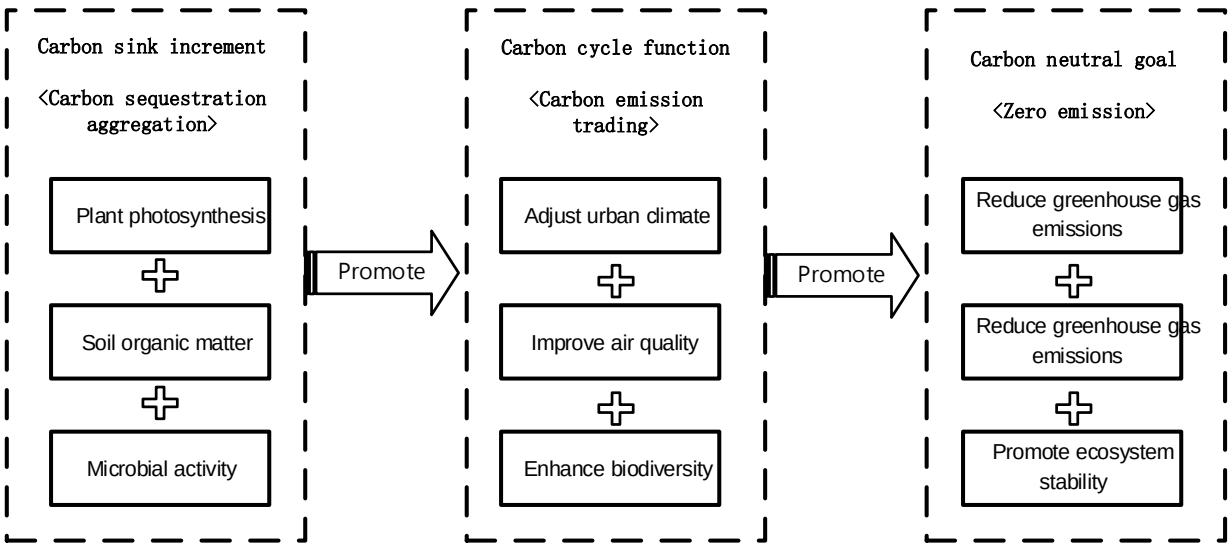

Figure. 1: Landscape architecture industry to achieve the goal of carbon neutrality path

Operation of carbon sink project management in PPP mode: seven processes include: project planning and design; Bidding and selection of partners; Contract signing; Construction phase; Operation phase; Income distribution; Termination and handover of projects.

Carbon trading platform is an Internet-based carbon emission trading system, which aims to reduce greenhouse gas emissions in a market-oriented way. Under the goal of carbon neutrality, landscape carbon sink projects can realize the trading and financing of carbon emission rights through carbon trading platform. Specifically, carbon sequestration projects can introduce more funds and technologies through the purchase, sale and mortgage of carbon emission rights, and improve the sustainability of the project (Figure2)

Actual carbon emission required for carbon control enterprises:

$$\text{Actual emissions} = \text{Initial quota} + \text{Trading Acquisition Quota (A+B+C)} \quad (1)$$

- CCER-Nationally Certified Voluntary Emission Reductions(A)
- Transaction Quota(B)
- The amount of carbon produced(C)

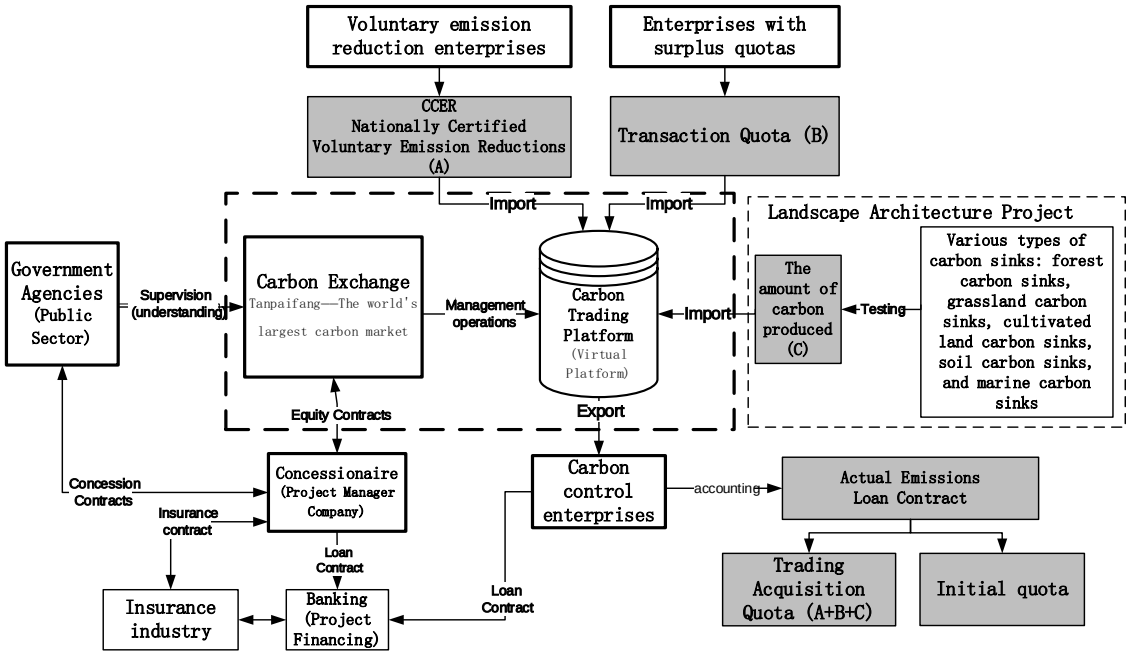

Figure. 2: Relationship between carbon sink and enterprise carbon trading of PPP mode landscape architecture project

4. Operation Mechanism and Benefit Evaluation of Landscape Architecture Carbon Sequestration Project under PPP Mode and Case Study

4.1 Operation Mechanism of PPP Mode Landscape Architecture Carbon Sequestration Project

Landscape architecture carbon sink projects under PPP mode usually adopt bidding and concession management, and the private sector is responsible for the investment, construction and operation of the projects. In the preparatory phase of the project, the government will sign a contract with the private sector to clarify the rights and obligations of both parties. The private sector is responsible for raising funds, building and managing carbon sink projects, while taking certain risks. In the operational phase of the project, the private sector can earn profits by selling carbon emission rights, and at the same time pay a certain fee to the government.

In addition to trading carbon emission rights, the carbon trading platform can also provide financing services for projects. The private sector can obtain loans by mortgaging carbon emission rights, which can be used for the construction and operation of projects. In addition, the carbon trading platform can also provide services such as verification of carbon emission data monitoring reports for the government and enterprises to ensure the authenticity and accuracy of carbon emission data.

4.2 Economic, Social and Environmental Benefits and Risks of PPP Landscape Architecture Carbon Sequestration Project

The risk management measures for engineering tendering and bidding contracts under PPP models mainly include the following aspects: establishing a sound contract management system, strengthening the review and approval of contract terms, establishing a supervision mechanism during the performance of contracts, and properly handling contract disputes.

The economic benefits of PPP mode landscape architecture carbon sink project mainly come from the sales revenue of carbon emission rights and the return on

investment of the project. By building and managing carbon sequestration projects, the private sector can obtain a stable source of income, thus realizing the profitability of the projects. At the same time, the landscape architecture carbon sink project under PPP mode can also bring certain contributions to local economic development and promote employment and economic growth.

(1) In addition to economic benefits, the landscape architecture carbon sink project under PPP mode also has significant social benefits. Through the implementation of the project, the urban ecological environment can be improved and the quality of life for residents can be improved. At the same time, the project can also promote the development of local ecotourism, increase tourism income and employment opportunities.

(2) In terms of environment, the landscape carbon sink project under PPP mode can effectively absorb carbon dioxide in the atmosphere, reduce the concentration of greenhouse gases and alleviate climate change. In addition, the implementation of the project can also improve soil quality, improve water quality and protect biodiversity.

(3) Risks of carbon sink projects in landscape architecture under PPP mode. For example, the long investment return period of the project and the large market volatility may lead to the increase of investment risks of the private sector. In addition, there may be environmental protection problems and technical problems in the construction and operation of the project, which also need attention.

To sum up, the landscape architecture carbon sink project under PPP mode has significant economic, social and environmental benefits. By introducing private sector investment and operation, the efficiency and sustainability of the project can be improved, and local economic development and environmental protection can be promoted. However, during the implementation of the project, it is necessary to pay attention to the risks and challenges and take corresponding measures to ensure the smooth progress of the project and achieve the goal of carbon neutrality.

4.3. Case Study on PPP Project of Landscape Architecture Carbon Sequestration

At present, I have experienced quite a lot in China's domestic carbon trading center. Successful cases, such as: laying a pioneering foundation for the development of farmland carbon sinks in 2022. Fujian Strait Resources and Environment Trading Center, Ninghai County People's Government, Fujian Huarong Environmental Protection Co., Ltd., etc. The first 7,000 mu farmland carbon sink project jointly planned and promoted was successfully completed in Fujian Strait Equity Exchange Center. The first bivalve marine fishery carbon sink project in Fujian was also quite successful.

4.3.1 Case study of PPP mode of carbon sink in landscape architecture carbon sink data

The PPP trading mode of carbon sinks mainly involves public-private cooperation, in which the government and the private sector participate in project investment, construction and operation. The following is a specific case of carbon sink PPP trading mode (Table 1):

The specific carbon trading data of the above cases are as follows:

(1) Carbon sink function: The project absorbs about 5000 tons of carbon dioxide every year by planting a large number of trees and other plants. This is equivalent to reducing the carbon emissions of about 2,000 cars.

(2) Carbon emission trading: The project offsets about 3,000 tons of carbon dioxide emissions every year by purchasing carbon emission rights of other emitters. At the same time, the project also sold some additional carbon emission rights, and introduced about 10 million yuan of capital and technical resources for the project.

(3) Carbon neutrality Contract: The project has signed a carbon neutrality contract with the buyer on the carbon trading platform, promising to achieve the carbon neutrality goal within a certain period of time. In this way, the project further promotes the sustainable development and implementation of the project.

4.3.2 Actual effect and existing problems

Through the in-depth study and analysis of the selected cases, we can discuss the actual effect and existing problems of PPP mode of carbon sink in landscape architecture. This paper discusses the implementation effect of PPP project of landscape architecture carbon sequestration, the realization of carbon sequestration function, the existing problems of PPP mode, and the improvement measures and suggestions. Through the comparative analysis of different cases, found that the advantages of the project is to promote environmental protection and sustainable development, the disadvantages are low return on investment, operation management needs to be improved. At the same time, the lack of policy support is also one of the main challenges faced by project implementation.

Therefore, it is necessary to strengthen policy support, improve the return on investment, optimize operation and management, etc., in order to promote the healthy development of PPP projects in landscape architecture carbon sinks. These measures and suggestions can provide reference for future popularization and application.

Table 1 Case of PPP Trading Mode of Carbon Sink in Landscape Architecture Project

Project	Specific description
Project name	Wetland Protection and Restoration Project in XX Area
Project site	XXXX Wetland Park of XX City, XX Province, China
Project scale	The total area is 1000 hectares
Project objectives	Through wetland protection and restoration, the carbon storage capacity of ecosystem is improved, greenhouse gas emissions can be reduced, and the goal of carbon neutrality can be achieved

Project implementation	Government tender	The government invited professional environmental technology companies to carry out the wetland protection and restoration project through public bidding. The company is responsible for the design, construction and post-monitoring of wetland ecological restoration in the project.
	Carbon sink function and carbon trading	● The project pays attention to the natural carbon sink function of wetlands. ● Through the protection and restoration of wetlands, the carbon storage capacity of wetlands is improved, and the greenhouse gas emissions are reduced. ● The project also uses the carbon trading platform to trade and finance carbon emission rights. ● The project offsets its actual emissions by purchasing the carbon emission rights of other emitters. ● The project also introduced more capital and technical resources by selling carbon emission rights. The project has signed a carbon neutrality contract with the buyer, promising to achieve the goal of carbon neutrality within a certain period of time.
	Income distribution	According to the principle of PPP model, the income of the project will be distributed between the government and the private sector. In this project, part of the government's income from carbon trading will be used to support the continuous protection and restoration of wetlands.

5. Conclusions

This paper studies the carbon sink function of gardens under the goal of carbon neutrality and the role of carbon trading platform in PPP mode. Through research, it is found that landscape architecture, as an important ecosystem, has significant carbon sink function. In order to promote landscape carbon sequestration projects, PPP mode can be adopted to introduce private sector investment and operation to improve project efficiency and sustainability. PPP mode can transfer the responsibility of investing, building and operating landscape garden carbon sequestration projects to the private sector through bidding and franchising, and carbon trading platform plays an important role in landscape garden carbon sequestration projects.

The value of the PPP platform of carbon sinks constructed in this study can make the participants more aware of their relationship. This study can help increase public understanding of the carbon sink function of landscape architecture and encourage more people to participate in climate change adaptation.

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