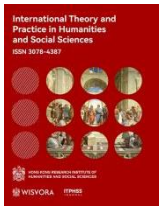
WISVORA

International Theory and Practice in Humanities and Social Sciences

2025 Volume2,Issue2 ISSN 3078-4387



The Relationship between the Effectiveness of Carbon Emission Reduction Policies and the Degree of Public Participation——A Study Based on the Perspective of Public Choice Theory

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Article Info

Accepted:01 January 2025

Keywords:

Macroeconomic Operation;
Public Choice;
Carbon Reduction;
Public Participation;

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http://doi.org/10.70693/itphss.v2i2.236

Abstract

Global climate change has brought carbon emissions reduction into the global spotlight, and the Chinese government has formulated emissions reduction policies and set targets for carbon peaking and neutralization. This article explores the relationship between policy effectiveness and public participation from the perspective of public choice theory. The article reviews carbon emission reduction research, analyzes the roles of various parties in political decision-making and the current status of China's policies, and emphasizes the importance of public awareness and participation in achieving climate goals. Finally, it proposes optimized policy recommendations, such as improving the carbon market, developing green finance, differentiating policy design, promoting demonstration projects and encouraging community and NGO participation.

1. Introduction

As the problem of global climate change has become increasingly serious, and its far-reaching impact on human society and the natural environment can no longer be ignored, carbon emission reduction has become a focal point of concern for the international community and national governments, which are working together to address the issue. In response to this global challenge, the Chinese government has constructed a comprehensive and systematic policy framework, the core objective of which is to effectively reduce greenhouse gas emissions in order to cope with the adverse impacts of climate change. This policy framework not only covers the specific deployment

of green and low-carbon development in the 14th Five-Year Plan, but also clearly sets out the ambitious goals of reaching peak carbon emissions by 2030 and achieving carbon neutrality by 2060, demonstrating China's determination and commitment as a responsible power. In order to ensure the effective and orderly implementation of carbon emission reduction policies, the Chinese government has also continued to improve the relevant laws and regulations. The revision and strengthening of the Law on Prevention and Control of Air Pollution has provided a solid legal guarantee for reducing air pollution and controlling greenhouse gas emissions. At the same time, the introduction of special laws and regulations, such as the Administrative Measures for Carbon Emission Trading, has encouraged enterprises to take the initiative to reduce carbon emissions through the innovation of market mechanisms, and promoted the optimal allocation of carbon resources. The successive implementation of these laws and regulations has laid a solid foundation for the carbon emission reduction policy to take root.

As an important means to cope with climate change and promote the green transformation of the economy and society, carbon emission reduction policy plays a pivotal role in promoting green and low-carbon development and realizing sustainable development goals. It not only helps to accelerate the optimization and adjustment of energy structure and promote the wide application of clean energy, but also promotes the upgrading of industrial structure and guides the economic and social development in the direction of more environmentally friendly and low-carbon development.

However, in the face of the complex and arduous task of carbon emission reduction, how to ensure the effective implementation of the policy and further improve its social acceptance and public participation has become an important challenge for current policy makers. This requires us to continue to innovate and improve in all aspects of policy design, implementation and supervision, and at the same time strengthen public education and publicity to enhance the environmental awareness and participation of the whole society, so as to jointly contribute to the construction of a better future in which human beings and nature coexist harmoniously.

Public choice theory highlights the similarities between political and economic processes, particularly in the motivation of individual behaviour. In the context of public policymaking, various types of participants, such as politicians, bureaucracies and voters, are viewed as rational actors pursuing the maximisation of individual interests. This pursuit may lead to biases in the process of policy formulation and implementation, which in turn may trigger efficiency losses. Accordingly, we can more accurately assess the effectiveness of existing policies, identify their potential shortcomings, and explore how to improve policy efficiency and public participation through reform. The application of public choice theory can facilitate policy makers to better take into account the public's needs and preferences when designing and implementing carbon emission reduction policies, thus enhancing the fairness and transparency of the policies.

2. Literature review

Regarding the related research on carbon emission reduction, scholars have explored different aspects respectively. Reducing greenhouse gas emissions and atmospheric pollution is a key responsibility of environment and climate management. Promoting the simultaneous optimisation of pollution control and carbon emission reduction is an effective way to achieve a comprehensive green transformation of the economy and society, which supports the construction of an ecologically civilised China and the achievement of peak carbon and neutrality targets(Zhao Manyi, & Wang Ke,

2024). To this end, the state has formulated different policies and to promote the implementation of carbon emission reduction. For example, the implementation of the green financial reform and innovation pilot zone policy can strengthen the financing constraints of heavily polluting micro-enterprises and thus reduce their carbon emissions, and on a macro level, carbon emission reduction can be achieved by optimising the energy consumption structure and promoting green technological innovations(Zhang Zhenghua, Chen Xi, Wang Jing, & Feng Yanchao, 2024). In the context of the implementation of the "Broadband China" strategy, some scholars have found that this initiative has a significant effect on carbon emission reduction, especially on CO2 emissions in mature cities and cities in western China(Zhang Youzhi, Liu Yinke, Zhao Jing, & Wen Simin, 2024). Based on the horizontal ecological compensation policy for river basins, the policy can significantly reduce carbon emissions by promoting scientific and technological innovation and upgrading the level of financial development, with differentiated effects on cities with different environments(Yuan Ruhua, & Jia Kuiyuan, 2024). At the same time, the development of digital economy can be achieved through the four directions of "digital finance-led", "digital technology-led", "digital industry-led" and "industrial digitalisation-led". digital industry-led" and "industry digitalisation-led" paths to empower the carbon emission reduction process(Zhang Xiufan, & Liao Zhongju, 2024).

Regarding the research on the relationship between carbon emission reduction and public participation, scholars have conducted relevant studies from the government, enterprises, and society and society respectively. On the governmental level, some scholars point out that the government's attention to environmental governance and the construction of a good government-enterprise relationship can well reduce carbon emissions and inhibit the emission of environmental pollutants, such as sulfur dioxide, to a certain extent(Fan Dan, Yang Zhongyuan, & Fan Panlai, 2024). Based on the enterprise level, (Xu Jinhua, Ye Feisan, & Li-Xia Shang, 2024) based on micro-enterprise data, found that public environmental concern enhances the carbon performance of enterprises through optimising the regional energy consumption structure and promoting green innovation of enterprises respectively, and exerts a significant influence on enterprises with different property rights. Based on the social level, the promotion of new energy vehicles is an important initiative to promote carbon emission reduction, and public environmental participation is an important transmission channel for new energy vehicle pilot cities to promote regional carbon emission reduction(Sun Zheyuan, & Song Fenghua, 2022). Meanwhile, environmental information disclosure helps to better engage the public in carbon emission reduction initiatives and further strengthen carbon implementation(Zhang Hua, & Feng Feng, 2020).

Although there is a lot of literature on carbon emissions and its relationship with public participation, based on the perspective of public choice theory to explore the effectiveness of carbon emission reduction policies and the impact of public participation. In addition, China is still in the early stage of establishing a national carbon market, and there are some deficiencies in the current regulatory system and content of carbon emission data, which cannot fully meet the needs of the new situation. To address this issue, this paper aims to explore the effectiveness and public participation of carbon emission reduction policies under the perspective of public choice theory. Through the research of this paper, we expect to reveal the influence mechanism of public participation on the effectiveness of carbon emission reduction policies, and provide useful reference and inspiration for policy makers. At the same time, it can stimulate more scholars and the public to pay attention to and think about carbon emission reduction policies, and jointly promote the realisation of green low-carbon development and sustainable development goals.

3. Application of Public Choice Theory to Carbon Emission Reduction Policies

3.1 Carbon reduction policies under public choice theory

Public choice theory profoundly reveals the nature of the political decision-making process, i.e., it is an interactive game played by multiple stakeholders around the maximization of individual interests. Under this framework, the formulation of carbon emission reduction policies is no exception, and it is the result of the interweaving and weighing of various forces. When participating in policy decisions, voter groups often express their support for these policies based on their desire for improved environmental quality and their sense of moral responsibility for the global climate change problem. They expect to leave a more livable planet for future generations by reducing greenhouse gas emissions. At the same time, politicians' motives for pushing for carbon reduction-related legislation are equally complex and varied. They may be motivated to advocate and push for these policies because they want to win the support of their constituents, enhance their political reputation, or because they have a strong personal belief in environmental protection. To a certain extent, these motivations of politicians have contributed to making carbon emission reduction policies an important issue on the political agenda. However, policy makers also have to face strong influence from special interest groups in the process of designing and implementing carbon reduction measures. These groups often possess strong economic power and lobbying capabilities, and their positions are often based on considerations of economic interests that may be in direct conflict with the public interest. For example, the fossil energy industry may oppose stringent carbon emission reduction policies because it may jeopardize their economic interests, while the new energy industry may actively support these policies in pursuit of market expansion and profit growth.

In formulating carbon reduction policies, policymakers also need to carefully weigh the distribution of costs and benefits of the policies. The potential economic costs of these policies, such as higher energy prices, will directly affect the daily lives and operations of consumers and businesses. Therefore, policy makers need to ensure that policies promote environmental protection without causing excessive impact on the economy, especially during the critical period of economic restructuring and upgrading. In addition, the effectiveness of policies is an important factor that policy makers must consider. This includes the actual impact of the policy on market behavior and whether more effective alternatives exist. For example, promoting carbon emission reduction through market mechanisms, such as the establishment of a carbon emissions trading market, may be more effective than mere administrative orders. In addition, policymakers need to pay attention to the long-term impacts of policies to ensure that they promote environmental sustainability while also achieving stable economic growth and harmonious social progress.

In the grand context of globalization, the transnational nature of climate change has become increasingly prominent, and the scope and depth of its impacts have made it difficult for any single country or region to deal with it unilaterally, thus highlighting the indispensability of international cooperation in promoting the achievement of the global goal of emission reduction. The challenges posed by climate change, such as the frequent occurrence of extreme weather events, sea level rise and ecosystem imbalance, not only threaten the living environment of human beings, but also pose a serious challenge to global economic stability and development. Therefore, the joint formulation and implementation of carbon emission reduction policies through international cooperation has become

a key path to address climate change. Meanwhile, policy sustainability, as another core consideration, is crucial to ensure that carbon emission reduction policies can adapt to future economic and technological changes. As technology advances and the global economy evolves, energy structures, production methods and even consumption patterns are likely to change profoundly. Therefore, when designing carbon emission reduction policies, policymakers must consider these potential changes in a forward-looking manner to ensure that the policies not only meet current environmental challenges, but also continue to play an effective role in the future, and to avoid policies becoming obsolete and ineffective.

In the real world of information asymmetry and future uncertainty, policymakers face a huge challenge. They need to prudently assess and predict the long-term impacts of carbon emission reduction policies based on limited information and forecasting capabilities, including multiple dimensions such as economic, social, and environmental. This requires policy makers not only to have profound professional knowledge and analytical ability, but also to listen to a wide range of opinions from various parties, including scientists, economists, industry experts, and members of the public, in order to ensure that policy decisions are scientific and rational. Public choice theory provides important theoretical support in this context, emphasizing that the four key dimensions of economic efficiency, political feasibility, social equity and environmental benefits must be considered comprehensively when formulating carbon emission reduction policies. Economic efficiency requires policies to maximize the effect of emission reduction at the lowest cost; political feasibility focuses on whether policies can gain sufficient political support and social consensus; social equity emphasizes that policies should equitably distribute the costs and benefits of emission reduction to avoid disproportionate burdens on disadvantaged groups; and environmental efficiency is the ultimate goal of policies, i.e., to achieve significant environmental improvement and climate change mitigation. In the face of the serious challenge of global climate change, international cooperation and policy sustainability have become key to promoting the design and implementation of carbon emission reduction policies. At the same time, in the process of policy formulation, the comprehensive framework of considerations provided by public choice theory can help to harmonize and balance the economic, political, social and environmental objectives of policies, and promote global progress towards a low-carbon, green and sustainable future.

3.2 Analysis of the current status of China's carbon emission reduction policy

Currently, China was taking a series of measures to combat climate change and promote low-carbon development, reflecting its strong commitment to achieving the goals of carbon peaking and carbon neutrality. The country had set specific national autonomous contribution targets and promoted green and low-carbon development through legislative and policy frameworks guided by policy documents such as the Overall Programme for the Reform of the Ecological Civilization System. The establishment of a national carbon emissions trading market aims to incentivise enterprises to reduce emissions through market mechanisms. The restructuring of the energy mix is gradually reducing reliance on fossil fuels, while the development of renewable energy sources such as wind and solar energy is being emphasised. Programmes to improve energy efficiency and the development of a green financial system support the financing of low-carbon projects and the low-carbon transformation of the economy.

Reforms in the transport sector, including the promotion of public transport and new energy vehicles, were also reducing carbon emissions in that sector. China was actively involved in

international cooperation on climate change, such as the Paris Agreement, and was sharing emissions reduction technologies and experience with other countries on the international stage. Raising public awareness of climate change and encouraging low-carbon living practices are also part of current policies. Low-carbon pilot projects in a number of cities and regions are exploring effective carbon reduction models. Ecological protection and restoration efforts are also being strengthened to enhance carbon sink capacity. Despite the progress made, China, as the world's largest carbon emitter, still faces challenges such as economic restructuring, energy transformation and technological upgrading. In the future, China would continue to strengthen policy implementation and technological innovation in order to achieve its carbon emission targets.

3.3 Relationship between current carbon reduction policies and the effectiveness of public participation

The effective relationship between carbon reduction policies and public participation is critical to achieving climate change goals. Governments provide a clear direction for public participation in emission reduction through legislation and incentives, while public awareness is achieved through education and publicity, which are essential for promoting the active participation of individuals and communities. Social mobilisation involves individuals, businesses and non-governmental organisations (NGOs), and policy acceptance and public support are key to successful implementation. Policies encourage the public to change their consumption behaviours and living habits to facilitate the adoption of green lifestyles. Public feedback on the policy is an important basis for adjusting and optimising the policy to ensure that it is both fair and effective.

Access to technology and information is fundamental to public participation in reducing emissions, while economic incentives such as subsidies and tax breaks can increase the public's motivation to participate. Demonstration of carbon emission reduction by governments and companies can motivate the public to follow, while long-term commitment and sustained efforts are essential to maintain public participation. The ability of carbon reduction policies to stimulate and sustain broad public participation and to adapt to changes in public needs and behaviours is of great importance.

3.4 Shortcomings in the implementation of current carbon reduction policies

Although China has implemented a series of carbon emission reduction policies and achieved certain results, it still faces a number of challenges and deficiencies in the process of achieving the ambitious goals of carbon peaking and carbon neutrality. These include the imbalance of regional development, which has led to differences in the implementation of emission reduction measures in different regions; the slow transformation of the energy consumption structure, with fossil fuels still dominating; and the need for further strengthening of technological innovation and application, especially in improving energy efficiency and promoting clean energy technologies. The implementation of carbon emission reduction policies may be insufficient in certain regions and industries, and market mechanisms such as carbon emissions trading need to be improved and public participation enhanced.

Economic restructuring and industrial upgrading faced resistance in certain regions that relied on high-carbon industries, and the balance between financial inputs and economic development was a challenge. In terms of international cooperation, there is a need to enhance coordination and joint action with other countries to address climate change. In terms of policy coherence, cross-sectoral and inter-regional integration is needed to avoid conflicts in implementation. The monitoring,

reporting and verification (MRV) system for carbon emissions also needs to be strengthened to ensure data accuracy and transparency. At the same time, measures to adapt to climate change should also receive more attention to address its impacts. The development of green financial instruments and markets needs to be innovated and improved to better support low-carbon projects.

4. Recommendations for optimising the design and implementation of carbon reduction policies

4.1 Improving the carbon emissions trading market, enhancing the decisive role of the market in the allocation of resources and ensuring the fairness and effectiveness of the market.

First, the establishment of a clear regulatory framework and harmonised trading standards is fundamental, as they provide clear legal and operational guidance for the operation of the market. Secondly, fair competition can be promoted and violations corrected in a timely manner through the establishment of a fair market access and exit mechanism. In addition, the formation of a carbon pricing mechanism based on market supply and demand can truly reflect the environmental cost of carbon emissions, thereby incentivising enterprises to take measures to reduce emissions.

Enhanced regulatory and oversight mechanisms, as well as increased transparency in information disclosure, are essential to prevent market manipulation and fraud, while ensuring that all stakeholders have access to necessary market information. Enhanced market liquidity can improve the efficiency of carbon emission rights trading by attracting diversified participants. The expansion of international co-operation not only facilitates cross-border trading, but also helps to share best practices and enhance the overall effectiveness of global emission reduction.

The promotion of public education and participation will help raise social awareness of climate change issues, thereby creating a favourable atmosphere in support of emission reduction policies. Technological innovation and support for R&D are key to promoting the development of low-carbon technologies and energy transformation. Finally, setting and adhering to long-term emission reduction targets and planning provides the market with a clear direction and expected stability.

4.2 Developing green finance to provide financial support for low-carbon projects and channels for public participation in green investment.

Promoting the development of green finance is critical to supporting low-carbon projects and facilitating public participation in green investments. Governments should formulate a comprehensive policy framework to encourage financial institutions and individual investors to actively engage in green investment through incentives such as tax incentives, financial subsidies and risk compensation. Financial institutions need to innovate and launch diversified green financial products, such as green bonds and funds, while establishing a comprehensive risk assessment system to help investors make informed investment decisions.

Increasing the transparency of green projects is key to enhancing investor confidence, which needs to be achieved through mandatory information disclosure and the establishment of green rating and certification systems. In addition, raising public awareness of the importance of green finance through education and public outreach will inspire them to participate in green investments. The

creation of easily accessible green investment platforms and the lowering of investment thresholds will enable a wider group of people to participate.

In order to enhance the maturity of domestic green finance, it is crucial to strengthen cooperation with international financial institutions and organisations and to introduce advanced international green finance concepts and technologies. Dedicated green financing support for small and medium-sized enterprises to facilitate their green transformation, thereby expanding the scale and impact of the green economy, could advocate that investors adopt a long-term investment perspective, recognizing the long-term value and potential returns of green investments.

4.3 Designing differentiated carbon emission reduction policies to suit the level of economic development and industrial characteristics of different regions.

The Government needs to conduct in-depth analyses of the level of economic development, industrial structure and carbon emissions of each region. On this basis, policies should adopt a differentiated approach, identifying and targeting high-energy-consuming and high-emission industries, while exploring potential industries for low-carbon transformation. A mechanism combining incentives and constraints, such as tax incentives, financial subsidies and a system of emission allowances and fines, should be established to promote enterprises to take action to reduce emissions.

In addition, it provides enterprises with services for the transfer of low-carbon technologies and energy efficiency upgrading, and strengthens capacity-building support, especially for local governments and enterprises in the formulation and implementation of carbon emission reduction measures. At the same time, public awareness of climate change issues was enhanced and their participation in emission reduction activities was encouraged.

To ensure policy flexibility and adaptability in response to changes in economic development and industrial structure, while establishing a strong monitoring, reporting and verification system to guarantee the transparency and effectiveness of emission reduction measures. From a long-term perspective, continuous emission reduction strategies and planning should be formulated to ensure policy continuity and stability.

4.4 Promoting carbon emission reduction demonstration projects to demonstrate the effectiveness of the policy through practical examples and to stimulate public participation.

Firstly, projects with broad representation and demonstration potential should be selected, and these projects should cover different industries and regions to reflect diversified emission reduction technologies and methods. Technical support and financial assistance should be provided to these projects to reduce the difficulty of implementation, and their feasibility should be enhanced through policy support such as tax incentives and financial subsidies.

Publicity and promotion are key, and the results and experience of demonstration projects are widely disseminated through multiple channels, such as the media, exhibitions and seminars, so as to raise public awareness. At the same time, public participation is encouraged, whether through community activities, educational programmes or voluntary services, which can effectively enhance public participation and a sense of responsibility.

Replicating and extending the experience of successful demonstration projects to a wider scope to expand the effect of emission reduction. At the same time, international cooperation should be

strengthened to introduce international advanced emission reduction technologies and management experience to enhance the quality and effectiveness of domestic projects. Demonstration projects can be incorporated into the country's long-term emission reduction planning to ensure their sustainability, and the principle of fairness can be adhered to in the promotion process to avoid imposing unfair burdens on certain regions or groups.

4.5 Encourage community and non-governmental organisations to participate in carbon reduction activities and play a monitoring role in public participation and policy implementation.

Raising awareness of community members and NGOs on climate change issues through education and public outreach is the basis for generating enthusiasm for participation. Provide the necessary training and capacity-building support to ensure that they are equipped with the knowledge and skills needed to participate in and monitor carbon reduction activities. At the policy formulation stage, actively invite these organisations to participate in consultations to ensure that their voices and suggestions are heard and taken into account, which will help to enhance the quality of policies and public acceptance. At the same time, provide financial support for their carbon emission reduction projects, lower the threshold of participation, and enable them to easily access relevant information and resources through the establishment of an information-sharing platform.

Carbon emission reduction projects are carried out in collaboration with communities and NGOs, making use of their influence and expertise at the local level to enhance the effectiveness of project implementation. At the same time, these organisations are encouraged to monitor the implementation of the policy and provide feedback so that the policy can be adjusted and improved in a timely manner. Communities and NGOs with outstanding performance in carbon reduction activities should be recognised and rewarded as an incentive for more organisations to join the field. Establish community participation mechanisms, such as special carbon reduction committees, so that community residents can participate directly in the decision-making process.

5. Conclusion and Suggestion

From the unique perspective of public choice theory, this paper provides an in-depth and detailed analysis of the effectiveness of carbon emission reduction policies and their complex relationship with public participation. It is found that public participation is one of the key factors in measuring the success of carbon emission reduction policies, and that the general enhancement of public awareness and active participation play an indispensable role in promoting the realization of climate change response goals. This finding emphasizes the central role of the public in promoting the process of carbon emission reduction in their dual roles as policy recipients and practitioners. China has achieved remarkable results in the formulation and implementation of carbon emission reduction policies, demonstrating strong policy determination and practical action. However, while making achievements, it is also facing a series of challenges, including unbalanced regional development, relatively slow pace of transformation of energy consumption structure, and the need to further improve the level of technological innovation and application. These problems not only affect the overall effect of carbon emission reduction policies, but also pose obstacles to the enhancement of public participation. Based on the public choice theory, this paper puts forward a series of specific suggestions to improve the effectiveness of carbon emission reduction policies:

①Improve the carbon emissions trading market mechanism and give full play to the decisive role of the market in resource allocation. This includes the establishment of sound trading rules, improve transaction transparency, strengthen market supervision, ensure the fairness and effectiveness of the carbon emissions trading market, so as to incentivize enterprises to take the initiative to reduce carbon emissions and improve the efficiency of resource utilization. ②Develop green finance to provide adequate financial support for low-carbon projects, while broadening the channels for public participation in green investment. Through the innovation of financial products and optimization of financial services, guide social capital to tilt to the low-carbon field, and form a green financial system guided by the government, led by the market and participated by the society. ③Design differentiated carbon emission reduction policies to adapt to the differences in the level of economic development and industrial characteristics of different regions. This requires policy makers to fully consider the differences between regions, avoid a one-size-fits-all policy model, and ensure that the policies can accurately match the actual needs of the localities and improve the pertinence and effectiveness of the policies. ④ Actively promote carbon emission reduction demonstration projects to demonstrate the effectiveness of policies through actual cases and enhance public understanding and recognition of carbon emission reduction policies. Through the leading and driving role of the demonstration projects, the public will be motivated to participate in carbon emission reduction, forming a favorable atmosphere for the whole society to participate. ⑤ Encourage communities and non-governmental organizations to actively participate in carbon emission reduction activities, and give full play to their important role in public participation and policy implementation supervision. Through the establishment of an effective communication mechanism and cooperation platform, promote positive interaction among the government, enterprises, communities and non-governmental organizations, and jointly promote the implementation and continuous improvement of carbon emission reduction policies.

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