

Challenges and Coordination Mechanisms of Multi-stakeholder Collaboration in Watershed Ecological Protection Compensation Fund Operations

Xiaofei Ma

*School of Accounting, Wuhan College, Wuhan, China
626877246@qq.com*

Abstract. Watershed ecological protection compensation funds are a key vehicle for addressing the long-term funding bottleneck in the watershed ecological protection compensation mechanism. Their operation also requires close cooperation among the government, market and society. In practice, conflicts of interest, unclear rights and responsibilities, and information barriers are prominent, constraining the operational effectiveness of the funds. Viewing fund operation across its full process, this paper systematically identifies five categories of core stakeholders and their core needs, and shows that the underlying cause of multi-stakeholder collaboration difficulties is a structural mismatch between needs and responsibilities. On this basis, it develops a differentiated responsibility system covering compensation providers, compensation recipients, and other important stakeholders, and proposes a multi-stakeholder coordination framework comprising a diversified fund-pooling mechanism, a collaborative governance and allocation coordination mechanism based on balanced rights and responsibilities, and a multidimensional closed-loop performance oversight mechanism driven by information sharing. This study provides a reference for institutional improvement and multi-stakeholder collaborative governance of watershed ecological protection compensation funds.

Keywords: watershed ecological protection compensation, fund, coordination mechanism

1. Introduction

For many years, funding for watershed ecological protection compensation in China has relied heavily on fiscal spending at all levels of government. Therefore, the watershed ecological protection compensation fund is a key vehicle for implementing the compensation system and addressing the long-term funding bottleneck. It aims to broaden the sources of compensation funding and support the rolling development of funds.

With the increasing complexity of watershed governance, the traditional government-led, single-actor model is no longer sufficient to meet the ecological protection demands of cross-administrative boundary and multi-objective problems. Therefore, market and social participation in the operation of watershed ecological protection compensation funds is gradually becoming an important direction for the modernization of watershed governance.

These practical challenges raise three research questions. First, what problems do multiple stakeholders face when collaborating in the operation of watershed ecological protection compensation funds? Second, what responsibilities do these stakeholders bear in fund operations? Third, how can multi-stakeholder collaboration improve the operational effectiveness of watershed ecological protection compensation funds?

At present, several related research directions have been developed at different levels and in conjunction. In terms of cooperative governance, integrated whole-watershed governance, intergovernmental bargaining over powers and responsibilities, and multi-stakeholder co-governance are considered, and the role of different actors and the logic of their interaction and cooperation are analysed [1-3]. Ecological value accounting under the ecosystem service flow and water-footprint methods spatially matches ecological contributions with benefits [4-7].

Research on responsibility systems defines the powers, rights, and responsibilities of stakeholders in watershed ecological compensation from multiple dimensions. The most widely applied framework is a multi-stakeholder collaborative responsibility system based on collaborative governance theory, characterized by "government leadership + market participation + social coordination + watershed-agency coordination" [8, 9].

Research on coordination mechanisms covers several dimensions. At the fund-operation level, studies propose diversified funding systems [9-11] and recommend broadening financing channels through market-based instruments such as water-rights trading, emission-rights trading, carbon-sink trading, green bonds, and the EOD model, thereby exploring market-oriented approaches to fund operation [12, 10]. For collaborative operation, studies propose regular cross-regional joint meetings and joint monitoring platforms [13], use the river and lake chief system to promote cross-departmental functional integration [2], and broaden channels for public participation [14]. For performance oversight, studies call for moving beyond a single focus on water-quality assessment and developing a multidimensional evaluation system covering water quality, water quantity, carbon sinks, ecological contributions, green development, and livelihood improvement [15, 8], while introducing independent third-party evaluation to strengthen the objectivity of oversight [15]. In addition, some scholars have examined the effects of compensation policies on green water use efficiency and urban water environmental total factor productivity [16, 17].

Although existing studies have made progress, several limitations remain. From the research perspective, many studies focus on a single stage, such as accounting or evaluation, rather than examining the full process systematically, and they give greater attention to intergovernmental relations than to incentives for market and social participation. From the perspective of responsibility systems, the boundaries of stakeholder rights and responsibilities remain unclear, the allocation of rights and responsibilities between upstream and downstream stakeholders is unbalanced, and the responsibilities of enterprises, social organizations, and the public have long been largely absent. From the perspective of coordination mechanisms, fragmented governance across regions and departments weakens the basis for collaboration, while consultation mechanisms are narrow in scope and have limited practical applicability.

The three research arrangements of this paper are as follows: First, identify the essential parties and their demands to explore the problem of cooperation, and then consider the reasons behind this problem in three areas. Second, the responsibility system is constructed by differentiating stakeholder responsibilities at each stage according to stakeholder needs and watershed characteristics. Third, it introduces three kinds of coordination mechanisms to build a closed-loop management system.

2. Results

2.1. Challenges in multi-stakeholder collaboration in the operation of watershed ecological protection compensation funds in China

First, incentive compatibility is absent in the fundraising stage. Second, there is no unified fund management covering routine management, investment, and return distribution [10], and the allocation of rights and responsibilities in fund distribution and use is also ambiguous. At the same time, the division of responsibilities among the government, market and social actors is unclear, and a cooperative order specifying "who leads, who supports and who supervises" has not yet been established [8, 9]. Third, information and capacity constraints in supervision and evaluation. Cross-regional data-sharing mechanisms for multidimensional indicators of water quality, water quantity and ecological contribution are still lacking, and information asymmetry is relatively high [15].

2.2. Construction of a responsibility system for watershed ecological protection compensation fund operations

Using the alignment between needs and responsibilities as its analytical logic, this paper systematically identifies five categories of core stakeholders in the operation of watershed ecological compensation funds.

Compensation providers supply funding for watershed ecological compensation funds and are direct beneficiaries of the resulting ecological benefits. As fund contributors and initiators of compensation agreements, downstream governments primarily need upstream water quality to consistently meet required standards and watershed ecological security to be protected. Their main responsibilities include fulfilling compensation agreements, disbursing compensation funds on schedule, and carrying out joint monitoring at transboundary sections [18, 19]. Private capital in downstream areas, as an important investor in the fund and an operator of green industries, primarily needs a stable supply of watershed ecological resources, clear expectations regarding policy compliance, and reasonable investment returns. Its main responsibilities include investing in green-industry projects, operating ecological restoration projects, and fulfilling corporate environmental and social responsibilities.

Compensation recipients are the main parties responsible for ecological protection and the recipients of compensation funds. As compensated parties and implementers of ecological protection, upstream governments primarily need compensation for losses in development rights. Their main responsibilities include managing water quality within their jurisdictions, promoting the green transformation of industrial structures, and ensuring the compliant use of compensation funds [18, 19]. Members of the public in upstream areas, as grassroots participants in ecological protection and supervisors of fund operations, primarily need improvements in the quality of their living environment, accessible channels for participation, and stable livelihoods. Their main responsibilities include adopting green lifestyles and participating in public oversight of fund operations [13, 14].

In addition to the two core parties to compensation, fund management companies, research institutions and expert teams, and social organizations are also important stakeholders. Fund management companies, as professional operators of fund assets, primarily seek fund security and reasonable returns. Their main responsibilities include making fund investment decisions, managing post-investment operations, preserving and increasing asset value, and implementing return-distribution plans. Research institutions and expert teams provide technical expertise and support for

performance evaluation. Their core needs are platforms for applying research and technical outputs in practice and opportunities to enhance academic impact. Their main responsibilities include providing technical support for ecological value accounting, conducting independent evaluations of fund performance, and calculating compensation standards [15, 16]. Social organizations serve as links in social collaboration. Their core needs are to realize public-interest objectives and strengthen multi-stakeholder co-governance. Their main responsibilities include policy communication and public education, establishing channels for public participation, and conducting third-party evaluations.

2.3. Coordination mechanisms for multi-stakeholder collaboration in watershed ecological protection compensation funds

2.3.1. Diversified fund-pooling mechanism driven by interest coordination

An interest-coordination mechanism should balance public objectives with market returns so that the fundraising incentives of government, market, and social actors are mutually compatible.

2.3.2. Collaborative governance and allocation coordination mechanism based on balanced rights and responsibilities

Targeted, refined, and differentiated compensation agreements should clearly define the core boundaries of rights and responsibilities, the scope of duties, and rules for regular collaboration among upstream and downstream participants [1, 20], thereby supporting sound fund management and allocation.

2.3.3. Multidimensional closed-loop performance oversight mechanism driven by information sharing

Establish independent third-party evaluation institutions to enhance the objectivity of supervision [7], and directly link the assessment results to the allocation of compensation funds to form a closed-loop mechanism of "monitoring-evaluation-feedback-adjustment" [11, 15].

3. Conclusion

This paper is the first to study the responsibility system and coordination mechanism of multiple stakeholders in the operation of the watershed ecological protection compensation fund from this perspective. Based on this, the study presents the reasons behind stakeholder collaboration dilemmas and puts forward a system of solutions based on aligning needs with responsibilities to offer a new perspective and analytical framework for research on watershed ecological compensation.

This study establishes a multi-stakeholder responsibility system for watershed ecological protection compensation. Based on the core needs of all parties concerned, the framework has set different roles and specific responsibilities for various links in the operation of the compensation fund to lay a responsibility foundation for the continuous and stable operation of the fund.

Regarding coordination mechanisms, this study develops three mechanisms: a diversified fund-pooling mechanism driven by interest coordination, a collaborative governance and allocation coordination mechanism based on balanced rights and responsibilities, and a multidimensional closed-loop performance oversight mechanism driven by information sharing.

The key to developing these funds is to clarify the rights and responsibilities of relevant stakeholders, establish an operating framework based on government guidance, market operation, social participation, and upstream-downstream coordination, and develop rules for fundraising, return distribution, and risk sharing that are linked to watershed ecological contributions. Thus, a stable operating model with incentive compatibility and risk control can be established to share the rewards of watershed ecological compensation and switch from external funding to self-financing.

References

- [1] Zhu, R. X., & Li, P. Z. (2021). How can cross-regional watershed ecological compensation achieve horizontal coordination? A qualitative comparative analysis based on 13 watershed ecological compensation cases. *Journal of Public Administration*, 14(1), 170-190, 224-225.
- [2] Zhang, Q. (2023). Collaborative governance dilemmas and practical paths for horizontal ecological compensation in the Yellow River Basin. *Yellow River*, 45(8), 54-58, 67.
- [3] Cheng, C. G., Zhou, H. W., Tang, Y., et al. (2023). The importance of horizontal ecological compensation for watershed environmental governance: An examination from the perspective of central-local coordination. *Chinese Journal of Management Science*, 31(9), 278-286.
- [4] Shen, J. Q., Chi, C., Huang, X., et al. (2025). Horizontal watershed ecological compensation from the perspective of ecosystem service flows: A case of the main stem of the Yangtze River. *Economic Geography*, 45(4), 133-145.
- [5] Duan, H. X., Zhang, H. J., Du, J., et al. (2026). Ecological compensation zoning and standard accounting based on identification of potential and actual ecosystem service flows in the Yellow River Basin. *Acta Ecologica Sinica*, 46(16).
- [6] Sun, Y. Z., Tang, Z., Wang, Z. K., et al. (2025). Horizontal ecological compensation based on ecosystem services: A case study of the Chishui River Basin. *Journal of Natural Resources*, 40(1), 179-196.
- [7] Yuan, G. D. (2022). Quantifying ecological compensation standards for transboundary watersheds from the perspective of environmental costs. *Accounting Research*(6), 52-67.
- [8] Zhao, J. J., Ge, Y. X., & Li, Y. (2022). Effect of relationship quality on the level of multi-stakeholder collaboration in watershed ecological compensation. *Journal of Arid Land Resources and Environment*, 36(12), 32-40.
- [9] Yang, X. J., Fei, Z. X., & Ren, L. J. (2024). Differentiated driving paths of diversified watershed ecological compensation from a configurational perspective. *Chinese Rural Economy*(1), 96-114.
- [10] Li, Y. F. (2022). Building a horizontal ecological compensation mechanism for the whole Yellow River Basin. *Social Scientist*(8), 104-111.
- [11] Yuan, R. H., & Jia, K. (2024). Impact of horizontal watershed ecological compensation policies on carbon emissions under the dual-carbon goals. *Journal of Agro-Forestry Economics and Management*, 23(3), 377-386.
- [12] Liu, Z. Q., Zhang, H. Y., Dai, S. J., et al. (2026). Study on the ecological compensation mechanism for downstream areas below dams in water-source areas of water diversion projects from a whole-basin perspective. *Journal of Economics of Water Resources*, 44(1), 94-102.
- [13] Cao, Z. J., & Chen, X. L. (2026). A study on multi-stakeholder participation mechanisms in trans-provincial watershed ecological compensation: A case of the Xin'an River. *Yangtze River*, 57(2), 97-105.
- [14] Wang, H., Zhou, F., Wang, X. C., et al. (2026). Mechanisms through which trans-provincial horizontal ecological compensation policies affect regional eco-environmental quality. *Research of Environmental Sciences*, 39(5), 1073-1083.
- [15] Xie, J., Liu, G. H., Zhang, Y. F., et al. (2024). Key issues in performance evaluation of trans-provincial watershed ecological protection compensation: A case of the Chaobai River Basin. *Ecological Economy*, 40(12), 154-161.
- [16] Huang, W. J., & Yang, B. H. (2024). Impact of the Xin'an River Basin ecological compensation policy on green water resource use efficiency. *Resources and Environment in the Yangtze Basin*, 33(9), 1969-1980.
- [17] Jing, S. W., & Zhang, J. (2023). Trans-provincial horizontal watershed ecological compensation and total factor productivity of urban water environments: A case of the Xin'an River Basin across Zhejiang and Anhui. *Urban Problems*(1), 89-99.
- [18] Ni, Z. L., Qin, Z. W., & Wang, L. (2024). From "dividing the river for separate governance" to "joint governance for prosperity": The impact of trans-provincial watershed ecological compensation on regional economic growth. *Inquiry into Economic Issues*(1), 92-104.
- [19] Lu, W. X., & Wu, F. W. (2022). Can horizontal transfer payments for ecological compensation narrow the urban-rural income gap? Empirical evidence from ecological compensation in typical Chinese watersheds, 2000-2019.

Public Finance Research(7), 35–51.

- [20] Chen, G. Y., & Gong, Y. X. (2023). How can trans-provincial horizontal watershed ecological compensation be achieved? A case study of governance in the Tingjiang-Hanjiang River Basin. *Journal of Public Management*, 20(1), 97–105, 173–174.