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Measuring Collaborative Governance Performance in Supply Chains: A Multi-Dimensional Evaluation Approach

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Abstract

This study proposes a multi-dimensional evaluation approach to measure collaborative governance performance in supply chains. By integrating Analytic Hierarchy Process (AHP) and fuzzy comprehensive evaluation, the research constructs a structured model capturing coordination, capability, and operational efficiency. The findings indicate that collaborative structures significantly influence system performance, while institutional conditions shape governance outcomes through constraint and incentive mechanisms. The study contributes to both methodological development and governance optimization.

Keywords

Supply chain; Collaborative governance; Performance evaluation; AHP; Fuzzy evaluation

1. Introduction

With the evolution of supply chains from traditional linear structures to complex networked systems, collaborative relationships among multiple actors have gradually become central to system operations. Collaborative governance, by integrating resources, optimizing processes, and reducing transaction costs, plays a critical role in enhancing overall supply chain performancExisting studies have primae. However, in practice, differences in institutional environments and inconsistencies in actor behavior introduce significant uncertainty into the collaboration process.

Existing studies have primarily focused on coordination mechanisms or organizational behavior, yet notable gaps remain in performance evaluation. In particular, there is a lack of multi-dimensional evaluation frameworks capable of capturing the systemic nature of collaborative governance, as well as limited methodological approaches to address the inherent fuzziness and complexity of

such systems. Therefore, it is necessary to develop a systematic performance measurement approach to better capture the actual performance of collaborative governance under complex conditions.

2. Methodological Design and Empirical Insights

2.1. Methodological Design

To systematically evaluate collaborative governance performance, this study constructs an analytical framework integrating multi-dimensional indicators, weight identification, and fuzzy evaluation.

First, the Analytic Hierarchy Process (AHP) is employed to determine the weights of evaluation indicators. Pairwise comparison matrices are established based on expert judgments, and consistency tests are conducted to ensure the reliability of the results. Second, a fuzzy comprehensive evaluation method is introduced to transform qualitative assessments into membership degrees, thereby enabling multi-criteria aggregation. Finally, the weights derived from AHP are integrated with the fuzzy evaluation outcomes to generate a composite performance index.

The evaluation system consists of three key dimensions—collaborative structure, system capability, and operational efficiency—which together capture collaborative governance performance from both holistic and operational perspectives.

2.2. Empirical Insights

Based on the constructed comprehensive evaluation model, the results indicate a significant positive relationship between the level of collaboration and overall system performance. Specifically, multi-actor collaborative structures demonstrate clear advantages in terms of system coordination and operational stability, with overall performance significantly outperforming single-dominant modes. In contrast, while single-dominant structures may achieve relatively high local efficiency in the short term, their lack of effective collaborative mechanisms limits their long-term coordination capacity and sustainable development potential.

Further analysis reveals that the institutional environment plays a critical role in shaping collaborative governance performance. Institutional constraints influence system efficiency by affecting actor behavior and collaborative decision-making processes. As institutional frictions intensify, collaborative efficiency tends to decline accordingly. In addition, the contributions of different evaluation dimensions to overall performance vary significantly, with the structural dimension exhibiting the strongest explanatory power. This highlights the central role of inter-organizational network relationships in supply chain collaborative governance.

3. Mechanism Discussion

Further analysis suggests that collaborative governance performance in supply chains is not determined by a single factor, but rather emerges from the interaction of multiple mechanisms. From a structural perspective, the network relationships among actors determine the pathways and efficiency of resource allocation, with different connection strengths and structural configurations directly influencing the depth of collaboration and system stability. From a behavioral perspective, the level of trust and the extent of information sharing among actors play a crucial role in shaping collaborative efficiency. High levels of trust reduce transaction costs and enhance willingness to cooperate, thereby improving overall performance. From an institutional perspective, formal rules and governance arrangements shape the boundaries of actor behavior through both constraints and incentives, significantly influencing collaborative decision-making and implementation processes.

Through the combined effects of these mechanisms, collaborative governance performance exhibits strong systemic and dynamic characteristics. That is, performance is not solely dependent on the optimization of a single dimension, but rather on the alignment and interaction among structural, behavioral, and institutional factors.

4. Implications for Governance Optimization

Based on the above findings, improving collaborative governance performance in supply chains requires a systematic approach across structural, institutional, and capability dimensions.

First, from a structural perspective, strengthening inter-organizational linkages and building stable and efficient collaborative networks are essential for enhancing resource flow and allocation efficiency. Well-designed network structures can reduce coordination costs and improve overall system coherence.

Second, from an institutional perspective, it is necessary to improve the institutional environment by reducing institutional frictions and uncertainties, thereby providing a stable foundation for collaborative governance. At the same time, effective incentive mechanisms should be developed to foster sustained cooperation among actors, enhancing the long-term effectiveness of collaborative governance.

Finally, from a capability perspective, emphasis should be placed on improving information-sharing mechanisms and resource integration capabilities. By strengthening information platforms and technological support systems, supply chains can enhance responsiveness and decision-making efficiency. Such capability improvements not only increase adaptability to external environmental changes but also contribute to the sustained optimization of collaborative governance performance.

5. Conclusion

This study develops a multi-dimensional evaluation approach for measuring

collaborative governance performance in supply chains and applies an integrated AHP–fuzzy evaluation method to quantitatively analyze complex systems. The findings demonstrate that collaborative structures and institutional environments are key determinants of performance, with multi-actor collaborative modes showing clear advantages in overall outcomes. The study provides a new methodological perspective for evaluating collaborative governance and offers practical insights for optimizing supply chain management.

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