Reflection on Collaborative Air Pollution Control in Chengdu-Chongqing Urban Agglomeration, China

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Abstract. Urban agglomerations in developing regions are often prone to synergistic dilemmas due to differences in motivation and execution. This paper takes Cheng-Chongqing urban agglomeration in western China as a typical case, and collects 303 policy texts from the government's official website from 2009 to 2020. The policy text analysis method is used to explore the spatio-temporal evolution of policies, policy subjects, policy objectives and policy tools, and to analyze the differences and synergy in air pollution control in depth. The results show that the current coordinated air pollution control in this area is mainly influenced by the order of the superior government and the promotion of the core cities of Chengdu and Chongqing, and shows a gradual and in-depth development trend. However, due to the differences in policy objectives and tools of collaborative governance subjects, the mining of voluntary collaborative governance forces and the use of different policy tools are not deep and perfect, and the equal cooperation among various subjects is still less.

1. Introduction

As a developing country, China's economy is developing rapidly, but resource consumption and environmental pollution are becoming more and more serious. In 2018, Yale University and Columbia University in the United States jointly released the Global Environmental Performance Index report: China ranked 177th, just above India, Bangladesh and Nepal. According to the data released by the State Administration of Environmental Quality in 2020, among 362 cities in China, Chengdu-Chongqing urban agglomeration is the most economically developed urban agglomeration in western China, and its AQI index ranks in the middle and lower reaches. Air pollution is not only an environmental problem, but also a social problem and an "urban disease" [1]. However, due to the differences in the main body of local governments, collaborative air pollution control is lack of motivation and practical effect. In this context, it is particularly important to explore the formation path of collaborative air pollution control network.

Many insightful conclusions have been drawn from the existing studies on the formation path of the cooperative air pollution control network. Roughly, it can be summarized as the study on the path of interest incentive and game, policy constraint and tool boost [2-3]. The superior government conducts consultation and interest game of multiple subjects through incentive compatibility [2], and the motivation of cooperative governance of air pollution is fully explored [3], making it possible for cooperative governance of air pollution. Policy tools and policy constraints are important ways to promote cooperative air pollution control [4], such as mandatory-coercion, market-led or public
participation, local governments can make the implementation of cooperative air pollution control feasible [4-6]. However, existing studies mainly focus on urban agglomerations with better coordinated air pollution governance, ignoring in-depth analysis of urban agglomerations with weaker coordinated air pollution governance.

Based on this, this paper attempts to discuss the following questions: whether the collaborative air pollution governance in Chengdu-Chongqing urban agglomeration has been normalized? If not, what causes and paths lead to the dilemma of coordinated air pollution control? In order to answer the above questions, this paper takes Sichuan-Chongqing urban agglomeration as an example and uses the policy text analysis method to analyze 303 policy texts in time, space, subjects, objectives and tools, so as to explore the formation path of coordinated air pollution control in developing regions and reflect on it.

2. Theoretical basis and research framework

2.1 Coordinated control and Coordinated control of air pollution

Collaborative governance theory is a new cross theory composed of the synergy theory in the field of natural science and governance theory in the field of social science [7]. See from figure 1, it has the following characteristics: (1) Emphasis on multiple subjects. (2) Emphasize the consistency of goals. (3) Emphasize autonomy and dominance. (4) Emphasize collaboration and integration. Collaboration, that is, the major bodies need to cooperate. (5) Emphasis on institutional constraints. Based on the characteristics of collaborative governance theory, we can find that the five factors influencing the effect of collaborative governance are subject, goal, organizational form, resource and information sharing, system and tool [8].

2.2 Institutional collective action and Coordinated control of air pollution

When urban agglomeration takes collective action, it will encounter the dilemma of collective action. The framework theory of institutional collective action proposed by Richard C.Feiock has become a panacea to solve this dilemma [9]. This theory includes the dilemma of institutional collective action and the dilemma resolution mechanism theory. See from figure 1, the institutional collective behavior theory and the pursuit of voluntary participation and implementation in higher-level departments can effectively solve the current behavioral dilemma. This paper uses this theory for reference when analyzing the collaborative governance mechanism and finds out the practical problems behind the difficulties faced by mechanism optimization from the predicament.

3. Case introduction and data source

In recent years, China’s economic strength and international influence have gradually increased. As one of China’s important national strategies, Chengdu-Chongqing City Agglomeration is one of the epitomes. In 2011, the Ministry of Housing and Urban-Rural Development, Chongqing Municipal Government and Sichuan Provincial Government jointly issued the Plan for Coordinated Development of Chengdu-Chongqing City Cluster to improve the spatial geography pattern and urbanization level of western China. With the rapid economic development of Chengdu-Chongqing city cluster, air pollution is also
becoming more and more serious. In particular, Chengdu-Chongqing Urban Agglomeration is located in the Chengdu Plain in the eastern part of Sichuan Basin and the middle and upper reaches of the Yangtze River, which belongs to the subtropical monsoon climate zone. The monsoon is developed, with little sunshine, more cloudy days and high humidity [10]. In winter, the high mountains around Sichuan Basin block the cold air from the north, so the wind speed in the inner plain is low and the calm wind is more, which makes the air pollutants in winter cannot be carried away by the wind and, and the air pollution is serious in winter.

Public policy refers to the code of conduct formulated by the government, non-governmental public organizations and the public in order to solve the common policy goals in the short term, solve the common social problems, and provide public products and services [10]. Therefore, the policies collected in this paper are governmental documents and normative behavior policy texts of the government, nongovernmental public organizations and the public. In this paper, two major data search methods are adopted: the collection of official website and the retrieval and sorting of "magic treasure of Peking University" [11].

4. Text study on air pollution control policies in Chengdu-Chongqing urban agglomeration

4.1 Time analysis

See from figure 2, from the perspective of the time, number and policy subjects of air pollution policies, the air pollution control in Chengdu-Chongqing Urban Agglomeration can be divided into three stages: the initial development stage from 2000 to 2015, the in-depth development stage from 2016 to 2018, and the stagnating development stage from 2019 and beyond. From 2000 to 2015, the curve showed a gradual upward trend and local governments carried out preliminary air pollution control. From 2016 to 2018, air pollution control has developed rapidly. The curve shows a trend of rapid rise with the increase of time. In 2019 and beyond, there will be fewer air pollution control policies due to new outbreaks in winter. During this period, the quantity curve of air pollution control policies showed a downward trend.

![Figure 2. Line chart of policy time evolution of Chengdu-Chongqing urban agglomeration](image)

4.2 Spatial analysis

See from figure 3, the policy issuance of Chengdu-Chongqing urban agglomeration has certain regional correlation characteristics and differences. In Chengdu-Chongqing city cluster, the first echelon is Chongqing, Dazhou and Chengdu. Chongqing and Chengdu are the most economically developed cities in Chengdu-Chongqing urban agglomeration. And Dazhou is the city closest to Chongqing. The second-tier cities are Deyang, Guang'an, Neijiang and Yibin. These cities are located in the dual core junction of Chongqing and Chengdu. The third-tier cities are those far away from Chengdu, Chongqing and Shuanghe. This shows that the unbounded nature of air pollution and the spillover of air pollution are indeed related in regional space, and it is very necessary to co-control air pollution.
Figure 3. Line chart of policy time evolution of Chengdu-Chongqing urban agglomeration

4.3 Policy subject analysis
From the perspective of longitudinal level between subjects, Chongqing has the largest number of published articles. On the one hand, as a municipality directly under the central government, Chongqing's jurisdiction is far greater than that of prefecture-level cities such as Chengdu. On the other hand, Chongqing is different from Sichuan Province in that as a city, its air pollution control issues are more trivial and complex. From the perspective of the main body of the joint publication, there are 14 policy texts. Among them, 5 subjects are in Chengdu, 6 subjects are in Chongqing and 2 subjects are in Mianyang. There is still little cooperation between different governments.

4.4 Policy objectives analysis
According to the policy text content analysis approach, using Nvivo software to encode 257 policy policy goals, coded 301 article policy goals, clustering and query analysis according to the content of policy objectives, the results are shown, Chengdu-Chongqing urban agglomeration in atmospheric pollution control of local government policy target, high consistency. See from table 1, 82% of the policy targets are driven by Sichuan Province or relevant laws and regulations. In addition, the coordinated air pollution control in Chengdu-Chongqing urban agglomeration is also inseparable from the strong promotion of Sichuan provincial government, and there are few nodes of voluntary cooperation between local governments. Meanwhile, voluntary forces accounted for only 34.6%. Among the voluntary forces, local governments mainly carry out air pollution control out of the consideration of territorial control and local competition for the honorary title of city. Finally, because some policy objectives are driven by both coercive and voluntary forces, voluntary and coercive forces account for more than 100%.

Table 1. Policy Objectives Coding Classification

| classify       | Major subclassification                  | Typical targets                                                   | percentage |
|----------------|------------------------------------------|-------------------------------------------------------------------|------------|
| Coercive force | Twelve-Five planning                     | Establishing ecological compensation system;                     | 82%        |
|                | The 13th five-year plan                   | Ambient air quality objectives;                                   |            |
|                | Action Implementation Rules              | "Three Battles" Leading Group;                                    |            |
|                | Establish a leading group                 | Environmental and air quality standards;                          |            |
|                | Make our skies blue again                 | PM2.5: SO2; NOx; Ozone;                                           |            |
|                | National Survey of Pollution Sources      | Find out about various sources of pollution;                      |            |


Sichuan - Chongqing Cooperation Demonstration Zone progress; Create civilized, clean and garden city Energy conservation and emission reduction; 34.6%
Emergency processing Establish a sound emergency response mechanism; Apanage management Construction dust;

4.5 Policy Instruments analysis
Nvivo software was used to manually code the policy tools part of the policy text, and 303 policy tools and measures were coded. See from table 2, the command-control type was the item, accounting for 49.3%. The market dominant type accounted for 16.8%; The type of public participation accounted for 22.1% in table 2. Command and control policy tools, namely "target decomposition task distribution", "environmental supervision and enforcement". The Chengdu-Chongqing Urban Agglomeration government uses command-and-control policy tools in air governance, preferring to establish a sound mechanism, and taking a series of target responsibility system such as assessment indicators as the governance means, which is also the main means. Market-oriented policy tools, namely "excessive punishment", "fiscal subsidies and incentives", etc., through the "ecological environment compensation system", "ecological tax", "pollution charge", "paid for the use of sewage's discharge right and trade", etc., can be found in Chengdu-Chongqing urban agglomeration of policy tools, the class is more, could be punished less consider incentive measures. The voluntary policy tools show remarkable consistency, mainly using "publicity and education", "reward reporting", "information disclosure" and so on. Moreover, the local governments of Chengdu-Chongqing urban agglomeration also pay more attention to and actively promote public participation.

Table 2. Policy Instruments Coding Classification

| classify | Major subclassification | Typical Instruments | percentage |
|----------|-------------------------|---------------------|------------|
| Control tool | Advance controls | Permits and quotas for pollutant discharge; | 49.3% |
| | Process control | Grid environmental regulation; | |
| | Afterwards controls | Punish illegal enterprises; Emergency warning; | |
| Market-based tool | Use market | Emission charges; Environmental tax; Subsidy; | 16.8% |
| | Create a market | Paid use and trading of emission rights; | |
| Voluntary tool | Information means | Information disclosure; Media exposure | 22.1% |
| | Citizen participation | Reward reporting; | |
| | Education and training | Publicity and education; | |

5. Difference and synergy: forming path analysis
At present, in the main body of collaborative governance, cross-city collaborative governance is still too few. See from figure 4, the coordination between cities still relies on the coercion of the superior
administrative force, namely Sichuan Province, and there is little willingness and behavior of voluntary and equal cooperation. This situation is mainly caused by the difference of motivation and behavior between the main body of Chengdu-Chongqing urban agglomeration.

In terms of the motivation of air pollution control, due to the competitive relationship between local government, no other cities have initiated cooperative governance initiatives except Chengdu and Chongqing. However, when analyzing the policy objectives, this paper finds that although there are differences in the policy objectives between cities, there are many identical policy objectives. Unfortunately, they did not dig into these policy objectives, forming a strong incentive for collaborative air pollution control. At present, the cooperation still remains in the mode of "command-implementation" and "proposal-participation". The form of cooperation is passive.

At the present stage, multiple tools have been used in the coordinated air pollution control in Chengdu-Chongqing urban agglomeration, but no institutional constraints have been formed. Although there are some cooperation policies, they only involve the direction and do not discuss about mechanism (trust, dialogue, consultation and sharing mechanism) in depth. At present, these aspects of Chengdu-Chongqing urban agglomeration are more or less mentioned in their own policies, without special mandatory policy constraints. In addition, the current policy tools proposed public participation, and reasonable use of incentive measures, also established a special technology in information sharing platform. However, public participation, and rewards and punishment strength is not enough.

**Figure 4**. Difference and synergy: forming path analysis

6. Discussions and conclusions

This paper finds that :(1) The air pollution control in Chengdu-Chongqing urban agglomeration can be divided into three stages, and the collaborative governance model is still in the initial development stage in the second stage.(2) The formation motivation of collaborative air pollution control in Chengdu-Chongqing urban agglomeration is mainly from the compulsory promotion of the higher level government, while the voluntary cooperation motivation is still low.(3) Collaborative air pollution control has not yet been normalized, which is due to differences in motivation and implementation means. Different from the coordinated air pollution control in urban agglomerations of developed regions, the motivation of coordinated air pollution control in urban agglomerations of developing regions is mainly the coercion force pushed by superiors, while the motivation of independent cooperation is still not high. In the aspect of execution, no normal institutional constraints have been formed. Based on this, this paper puts forward four policy suggestions for the motivation and implementation of collaborative air pollution governance :(1) further enhance the driving force of the higher level government and the influence of the core cities. (2) Actively explore the common goals of other cities' own policies. (3) Strengthen the use of multiple tools and co-governance of multiple subjects. (4) Forming normalization of coordinated air pollution control through institutional constraints.

7. References

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Acknowledgments
This research was funded by National Natural Science Foundation of China (72074129), Humanities and Social Sciences Research Fund of Ministry of Education (18YJC630105), Social Science Fund of Chengdu (2019R11) and Social Science Fund of the Science and Technology Department of Sichuan Province (2021JDR0218). The authors are grateful to all peer reviewers for their reviews and comments.