



Research on COVID--19 Prevention and Control Policies in China--Based on the Quantitative Analysis of Existing Central and Local Governments' Policies Text

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Abstract. The Chinese government had published a series of epidemic prevention and control policy during covid-19. We are able to reveal the emphasis, intention, and diffusion law of those policies published by the central and local government by analyzing them. First, Time-Series Analysis method is used to explore the policy diffusion pattern, and then the keyword co-occurrence method is used to analyze the cooperation network of the policy issuing institutions. Finally, the theme modeling and theme discovery of the central policy texts are carried out by constructing the LDA topic model. The trend of local and central policy release is roughly the same, and the spread of epidemic prevention and control policies shows the characteristics of policy explosion and policy fission; The main papers of central and local policies are mainly individual papers and supplemented by joint papers. There is a close relationship between the central and local policy themes, and local policies are generally improved and deployed along the direction of the central policy, but each has its own focus.

Keywords: Covid-19, Analysis on policies, Policy diffusion, Topic mining, Policy distinction.

1 Introduction

Coronavirus disease 2019 (covid-19) brought grave danger to our world. It threatened peoples' health, undermined social organization, and changed human lives. Covid-19 had caused 600 million confirmed cases and 6.58 million deaths by November 11 2022. Nevertheless, humans had taken 12.8 billion doses of vaccines by November 8 2022[1]. While the variant of covid-19 is multitudinous, Omicron is spreading persistently in China, putting enormous pressure on the government. In order to contain the development of the epidemic, maintain the social order, national security, and public security, boost the development of society and economy healthily, and protect the lives and property of Chinese citizens, the government published a series of policies.

The policies not only reveal the government act authentically, but also are the objective evidence to study the government act [2]. Development of the analysis methods such as semantics mining, topic evolution, social network analysis, etc provide

diversified perspective for metrical study on policies. In this study, from the policies that we collected and sorted out, based on the content analysis method by Peihua Shi[3], we built a multiple dimension analysis framework including time, space, subjects, and contents by combining subject analysis, co-word analysis, and social network analysis, discovering focuses of epidemic prevention and control, paths of the policies diffusion, and objectives of the policies evolution to provide references for the development of the policy coordination and governance system.

2 Experiment approach

2.1 Data collection and processing

The data in this research are collected from the Chinese central government website, the library of State Council, the local government websites, and Pkulaw Database from Peking University. We get the data set from utilizing Locoybooster, Python crawler, and manual screening. Then, we retrieved keywords like “epidemic”, “covid-19”, “covid”, “coronavirus”, “epidemic control and prevention” from January 20 2020 to September 1 2022. The policies’ information we selected contained policy headings, policy time, text contents, and posting agencies. Among these policies, we mainly choose notification announcements, advice, laws and regulations, etc. Letters and technology policies are not included. After filtering and de-emphasizing, there are totally 3263 effective policies. To study the coordinated COVID—19 prevention and control between central and local governments and the responses of local governments, we select Beijing and Shanghai city, Jiangsu and Hubei province as representative study objectives, comparing and analyzing different responses and policies from central and local governments during the epidemic.

On data pre-processing stage, due to the particularity of the policy text, we process new word discovery through NLPiR from the policies, combining with the proper nouns in official documents, to construct the custom dictionary of COVID--19 (661 in total). Then we import the custom dictionary into the lexicon to improve the segmenting. Next, we conduct word segmentation utilizing the segmentation system from the Chinese Academy of Sciences and process the stop-word by using Baidu stop-word list, Harbin Institute of Technology stop-word list, Intelligence Laboratory of Sichuan University stop-word list and stop-word library. Finally, we set up the corpora through Bag of Words, and establish the mapping relationship between lexicon and number.

2.2 Data analysis

In this article, starting from the levels of central and local government, we are studying policy coordination and differentiation and finding the policy priorities from various levels of government. Based on the analysis of multidimensional characteristics of policy, we establish the analysis framework of the policy from time, space, subjects, and contents, exploring the government relations and policies differences. In the dimension of time, we will study the trend of policy publication and response speed with the

methods of time series and diffusion analysis. From the subject of policies, we reveal the intergovernmental relations and coordination by constructing social networks. From the perspective of contents in policies, we can find the priorities and focuses of central and local epidemic prevention and control in various stages through policies' themes and thematic relationships.

2.3 LDA topic model construction and visualization

The LDA topic model, which is generated based on the Dirichlet distribution and three-layer Bayesian probability, is an unsupervised model that treats the document as the probability distribution of the topic and the topic as the probability distribution of the vocabulary. LDA model uses the relation between words, topics and texts to solve the mining problem in text clustering. The core formula (1) of this model is as follows:

$$P(z|\beta) = \sum_i^n P(z|t_i) * P(t_i|\beta) \tag{1}$$

z represents the document word, β represents the document, and the publicity represents the prior probability of the document under the different topic t_i .

The LDA document generation process is as follows:

1. Topic distribution for generating the DTH document:

$$\theta_d \sim \text{Dirichlet}(\alpha_\theta) \tag{2}$$

2. For each word n in the document:

- a) Generate the assigned topic of the word:

$$Z_{dn} \sim \text{Categorical}(\theta_d) \tag{3}$$

- b) Generate the word:

$$w_{dn} \sim \text{Actegorical}(\beta_{Z_{dn}}), \beta_k \sim \text{Dirichlet}(\alpha_\beta) \tag{4}$$

The theme set is obtained through LDA model training, and the policy themes are sorted according to the importance of the themes, as shown in formula (5), and word clouds are generated with the help of wordcloud to realize the purpose of theme discovery.

$$Imp_k = \frac{\sum_{d=1}^D N_d \theta_{dk}}{\sum_{d=1}^D N_d} \tag{5}$$

2.4 Co-word analysis

Co-word analysis is a cluster analysis of a group of words by pairwise counting their occurrence times in the same document, so as to reflect the affinity and disaffinity of these words. Cooccurrence intensity is calculated to reflect affinity and disaffinity, as shown in equation (6).

$$E_{ij} = \frac{s_{ij}^2}{s_i s_j} \quad (6)$$

s_i and s_j respectively represent the number of words in the text, and s_{ij} represents the number of co-occurrences.

3 Result

3.1 Analysis the policies within the dimension of time

Results show us the diffusion trend of central-local policies and local-local policies and response speed of local government to central government. At the beginning of the epidemic, the diffusion trend of epidemic prevention and control policies was fierce. By March 2020, the central government had published 743 policies and the local government had published 613 policies. Different from the gradual diffusion trend in the past, this trend is explosive and fissile[4]. Based on the development and changes of epidemic and the diffusion theory, we could divide the evolution of the policies into two stages.

(1) First stage: Explosive period of the policies (January 2020 - April 2020)

The breakout of covid-19 brings our life great challenges. At the early stage, the policy publication trend between the central and local governments are consistent, which means local governments actively respond to the call from the central government. Due to the robust political attention, the curve of publication from the central and local government are basically identical. From the time intervals for policies promulgation and policy evolvement paradigm, we can conclude that the diffusion mode is (central-provincial) top-down hierarchical adoption[5]. Local publications in all four cities and provinces that we studied corresponded to the central government, but the policy convergence in Beijing is more obvious, meaning that Beijing executes policies faster and more swiftly. Also, we can see that epidemic prevention and control policies spread from Wuhan to other provinces in expansionary diffusion mode.

(2) Second stage: Gradual period of the policies (After April 2020)

In this stage, the defense war in Hubei and Wuhan achieved decisive victory, covid-19 had been almost blocked out in China, and the epidemic prevention and control started to be normalized. In the late period, policy publication trends between the central and local government appealed to a larger distinction. This corresponds to the situation that the covid-19 is sporadic in China, meaning that scattered covid cases will lead to the outbreak in clusters in local areas. In February 2022, The Winter Olympic was held in Beijing, putting heavy pressure on the local government, and Shanghai city was also impacted in this wave of outbreak. The diffusion moved laterally from Beijing where it was affected by Omicron first to Shanghai[6].

3.2 Analysis the policies within the dimension of subject

The policy text is completed through the cooperation of various departments. In order to more intuitively and clearly show the cooperation of central and local policy topics, Gephi is used to analyze the network cooperation relationship of policy subjects.

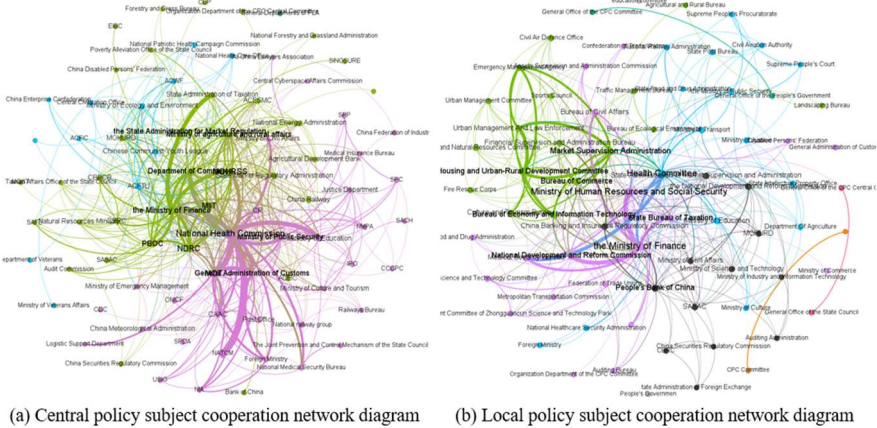


Fig. 1. Policy subject cooperation network diagram

In terms of joint issuance, among the 1083 policy texts issued by the central government, the number of joint issuance is 254, accounting for about 23.45%. Local governments issued a total of 2,283 policy texts, and the number of joint issuances was 418, accounting for 18.34%. It can be seen that the central and local epidemic prevention and control policies are mainly issued by the main body of the epidemic, supplemented by the characteristics of joint issuance. From Figure 1 (b), it can be seen that there are a small number of cooperation nodes linked to the central government in the local cooperation network diagram, such as the National Tax Administration-local Ministry of Human Resources and Social Security, the State Council-local Ministry of Science and Technology, etc. But in general, there are fewer joint issues between central and local departments, and the central government should give full play to its role as a bridge link.

Both central and local governments form a cooperative network graph connected through core nodes, but the local cooperative network has a weaker holistic character compared to the central network, with fewer connections between nodes and a relatively sparse network structure (see Figure 1). The central government has formed a network partnership centered on a number of departments, including the National Health and Wellness Commission and the Ministry of Finance, and there are a number of more obvious high-frequency partner agencies. The central cooperation network diagram shows the characteristics of closely connected network nodes and tight network structure. In contrast, the local network structure is more decentralized, forming a cooperative network with a few nodes such as the Finance Bureau and the Health and Wellness

Committee as the core. This can reflect the intricate cooperation between the central departments at all levels with their respective roles and division of labor.

3.3 Policy Content Dimension Analysis

The theme analysis of the epidemic prevention and control policy aims to discover the theme of the novel coronavirus epidemic prevention and control policy text issued by the central and local governments, and to study the policy focus and response measures. Firstly, the pre-processed central and local policy texts are divided into research stages based on the analysis results of the time dimension; secondly, this paper uses the topic consistency index as the basis for the selection of the optimal number of topics; then the LDA model is used for topic modeling and topic extraction of central and local policy texts; finally, the visualization is presented through word cloud diagrams.

(1) Explosive period of the policies

As mentioned earlier, the optimal number of topics for central and local policy texts is 6 and 5, respectively. On the basis of determining the number of topics, the LDA topic model was used to perform topic discovery on central government policies, and the results were presented in the form of a word cloud diagram. (see Figure 2 (a))

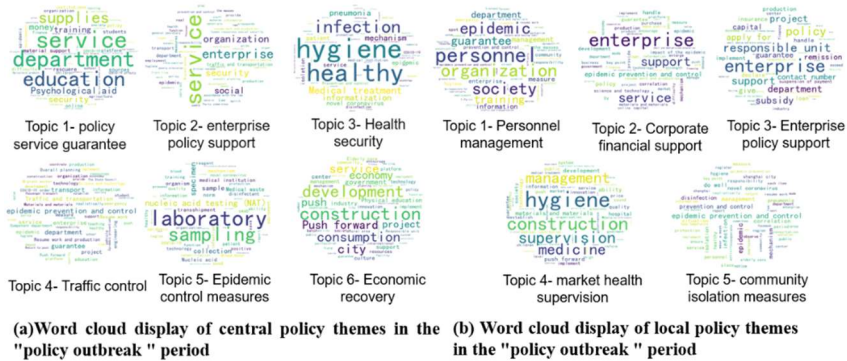


Fig. 2. “explosive period of the policies” word cloud map display of central policy themes

As can be seen in Figure 2 (a), the themes of the central policy in this period can be grouped into two main categories respectively, epidemic control and economic development. For the control of the epidemic, the main focus is on the treatment of COVID-19 patients and the construction of information-based online medical care (Topic 3), the disinfection of transportation means and the assurance of transportation materials (Topic 4), as well as the standardized procedures for collection, transport and preservation of laboratory samples of COVID-19 (Topic 5). For economic development, the focus is on production and job security driven by the resumption of production activities supported by corporate policies (Topic 2), as well as the recovery of consumption and the promotion of urban development and construction under various government initiatives (Topic 6). As for Topic 1 in Figure 2 (a), the words "education," "employment," "psychological assistance," "material security," and "assistance" indicate that the

government gave full play to its service-oriented government functions and provided effective and focused protection services for special people during this period.

From Figure 2 (b), it can be concluded that the local policy themes in this period focused on enterprise support, with strong support and many types of support for enterprises, mainly reflected in support for enterprises through financial institutions and financial relief and assistance for SMEs (Topic 2), as well as policy support such as tax moratoriums and exemptions for enterprises (Topic 3). It is noteworthy that the words "mask", "drug", "material", and "price" in Figure 2 (b) Topic 4 indicate that during this period, there was a chaos in the market for epidemic-related materials, and local governments issued policies to maintain social and market order. In addition, the policy topics focus on the training and organizational management of personnel (Topic 1) in order to effectively respond to outbreaks, and the problems caused by community epidemic isolation measures (Topic 5).

(2) Gradual period of the policies

As in the previous steps, the number of central and local themes is 4, which is shown by visualization (see Figure 3).

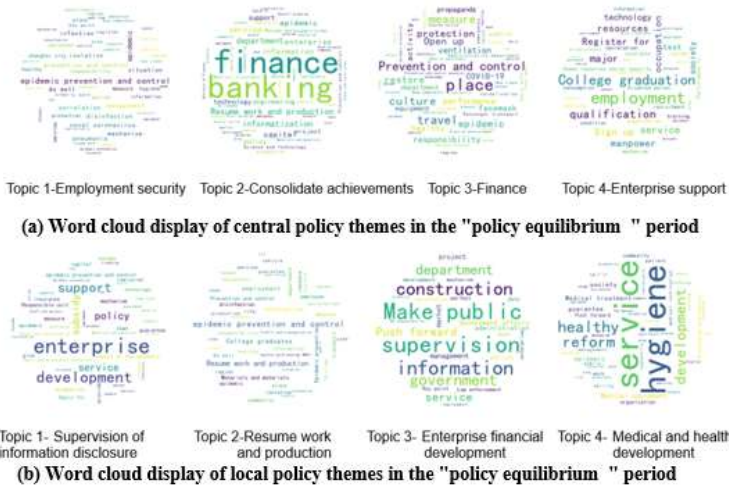


Fig. 3. “gradual period of the policies” policy word cloud display

During the policy taper period, the central and local policy themes were roughly the same, basically centering on prevention and consolidation and policy optimization and innovation, but each with its own focus (Figure 3). From Figure 3 (a), the central policy themes focus on post-epidemic economic recovery and social protection, with the former reflected in financial and informational support to promote the resumption of work and production (Topic 3), and business declarations (Topic 4). The latter is reflected in more precise and optimized epidemic prevention measures (Topic 2) to support the full resumption of work in sectors such as culture and tourism, and the provision of employment opportunities for college graduates and working people (Topic 1).

As for Figure 3 (b), local policies focus on information disclosure, and government departments have stepped up supervision to promote information disclosure (Topic 1).

It is worth noting that the words "health", "medical equipment", "development", and "reform" in Topic 4 indicate that local governments have summarized previous experience during COVID-19, and achieved medical equipment innovation, medical level improvement and medical development. During this period, local policies emphasized innovation in the system of resumption of production and prevention (Topic 2) as well as corporate financial reform (Topic 3).

4 Conclusion

The results of the study show that, in terms of analysis of the temporal and spatial dimensions, the policy release trends of local and central governments are roughly the same, with local governments actively responding to national calls and arrangements, and the proliferation of epidemic prevention and control policies showing the characteristics of policy fission. In terms of policy subjects, policy issuing subjects show a wide range and diversity, the central and local policy subjects have shown the characteristics of mainly issuing individual documents, supplemented by joint documents. However, joint issuance is not strong enough, and the central government should give full play to its role as a bridge. In terms of policy themes, the central and local policy themes are closely related and show similar characteristics, with thematic differences existing in that they focus on epidemic control and economic development, respectively. In terms of policy themes, the central and local policy themes are closely related and show similar characteristics, with differences mainly focused on economic development and epidemic prevention and control. The policy goal shifted from epidemic control and maintaining social stability to economic recovery and institutional improvement and innovation.

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References

1. WHO coronavirus (COVID-19) dashboard, <https://covid19.who.int/>, last accessed 2022/11/11.
2. Zhang, W.L., Bing T.Q., Xu, J., etc., Quantitative Textual Analysis of COVID-19 Prevention and Control Policies in China. *Journal* 33(08), 54-60 (2020).
3. Shi, P. H., Huo, Y.X., Research on Differences and Coordination of Tourism Enterprises' Resumption of Work and Production Policies in the Management of Major Public Health Crisis, *Journal* 35(04), 74-83 (2021).
4. Wen, H., Policy Diffusion in Crisis Situation: An Exploratory Study, *Journal* 22(04), 28-36 (2020).

5. Jiang, Y.W., Chen, J.L., Lin, L.J., etc., A Quantitative Study on Diffusion of Policies for Overcoming the Orientations of Papers Only, *Journal* 45(06), 89-97 (2022).
6. Bao, W.H., Research on the Types of Horizontal Intergovernmental Policy Diffusion, *Journal* 21(04), 2-13 (2022).

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