

Analysis of the Structure and Characteristics of Information Collaboration in Complex Networks Based on Public Health Emergencies

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Abstract: This study aims to provide a reference for emergency management departments to respond to public health emergencies and to explain the information coordination process of various subjects in public health emergencies through the correlation analysis of information coordination elements in public health emergencies. From the meaning of information coordination, the study defines and discusses the elements and traits of information coordination among numerous actors in public health situations. The article first describes the context and importance of the investigation, makes the topic and goal of the study clear, and then specifies the terminology and theoretical substance of the paper and offers the theoretical underpinnings for the argument. Through statistical analysis of the current state of the government's emergency information service using electronic questionnaires, it has been determined that the government's emergency management is lacking in three areas: organization and management, information technology, and operation and maintenance.

1 INTRODUCTION

At this point, emergency management presents the government with never-before-seen difficulties. The departmental responsibility-oriented emergency management model is unable to adapt to the difficult, wide-ranging, and ever-evolving challenges of managing major crises, particularly the grave consequences brought on by simultaneous and chain-transmission disasters, which cannot be addressed by the earlier small-scale emergency response programs.

The traditional government service paradigm is becoming inadequate to quickly gather first-hand information in emergency disaster situations in light of the contemporary information environment. Although "disaster type" data monitoring can gather comprehensive data on the nature, timing, intensity, and outcomes of a crisis, there is fragmentation between data collection departments and significant blockage and closure between information transmis-

sion and sharing, which cannot be resolved effectively and promptly by internal horizontal transmission or vertical reporting.

2 LITERATURE REVIEW

2.1 Collaborative Technology Perspective on Government Information Resources Building

Leveraging collaborative technologies to build government information resources. To more effectively access each local government's information reporting and feedback, Zhu Ruxun (2014) proposed integrating government information resources into a cloud computing environment, creating a new virtual data platform, offering cross-platform and cross-network data interaction and sharing services, and improving global planning and adjustment from top-level design. Blockchain technology was introduced by Gao

Guowei et al. (2018) into the reform of the government's basic information path, transforming each department into a point in the overall structure and creating a link between departments in the form of points to realize data exchange, realizing decentralization and de-marginalization; concurrently, the data is backed up and can be used multiple times in retrieval, boosting the efficiency and breadth of information usage. To clarify the future direction of optimizing the collaboration and development of key departments in China's smart government, Hu Mo and Ma Jie et al. (2020) depict the influence of government departments on the overall government and score the node linkages.

2.2 Government Information Resources Collaborative Sharing Perspective

Gan Yu and Liu Kunxiong (2015) propose four strategies to build a composite level of collaborative organizational relationship, improve the adhesion of information resources and services, insist on user-oriented full services, and form an interactive and circular system. They use the construction of innovative inter-regional information collaboration in Hunan Province as their starting point. In the form of actual study, Liu Huancheng and Li Yujie (2018) examined the current state of information resource sharing in China's collaborative government and proposed a solution to address the existing information resource occlusion issue from the standpoint of multi-body building. In order to solve specific types of problems in the middle ground, Feng Weichen and Liu Xinping (2018) brought incentive theory into government collaboration and information sharing and employed shared interests as the driving force behind collaboration.

2.3 The Lack of Detailing in Government Information Classification Research

Government information sharing and collaboration are examined by domestic scholars only from a macro perspective because they lack a thorough understanding of the information held by the various departments that make up the government as a whole. This causes a discrepancy between theory and reality in practical application. As a result, rigors categorization of government information study is required. It is necessary to better develop government information collaboration practice and research. The majority of

domestic scholars' theoretical research on collaborative government information service is abstract; it lacks field research and case studies on practical application; and it is unable to experience the working mode and working environment of information service in government work, leading to generalization and hollowing out of theoretical research.

2.4 Information Synergy Theory

Information synergy theory is a development of synergy theory, which dates back to 1976 and the generalization of the traditional theory from synergistic effects by German theoretical physicist Hermann Haken. The synergy theory states that synergy is a type of subjective and dynamic integrative behavior that causes the organizational components to develop a close, linked, and effective relationship with one another, leading to an amplified effect at work. The number of elements and subsystems cannot only be multiplied by or subtracted from one another. Synergy was initially used to explain the inherent laws of order and disorder of systems at the spatial scale, but as humanities and social sciences gradually became aware of it, its range of application and intrinsic significance were continuously expanded, giving rise to information synergy theory. Information synergy, according to Huang et al., is the spreading and sharing of information among several people and the new additive effect that results. The first thing, according to Zhang, is synergy, and the crucial element of information synergy is the occurrence of synergy-led action, which results in the multi-level processing of information and the combination of information into various synergistic roles, having a significant impact on the internal information system. Information synergy theory is currently understood in academic circles in a broad and ambiguous manner, demonstrating a gradual development of study from "connotation" to "extension". As opposed to the theoretical disparity, the field of practice is the primary source of study. Here, the framework for information generation in various scenarios is applied, and the naturally occurring group information synergy behavior is used as the detailed analysis object. In order to conduct study on information synergy, the primary scholars, led by Chen Rui, limit the occurrence of information synergy to the smart city and categorize the information synergy process into three stages of "initiation-flow-arrival."

3 METHODOLOGY

3.1 Questionnaire Design

In this paper, the collaborative service for sharing emergency information serves as both the study topic and the application subject. Four sections and 28 questions made up the questionnaire, which included both subjective fill-in-the-blank questions and objective multiple-choice ones. In order to describe and categorize the sample group, the first section of the questionnaire asks respondents about their gender,

occupation, education, and other basic details; the second section is about the respondents' initial understanding of emergency management, and it is used to find out how well they understand it. The third section is about the issues with government emergency management, and it looks into them from the perspectives of efficiency, information sharing, and emergency measures. The final section is about subjective questions, and it is used to find out how well the respondents understand emergency management. The third section examines the issues with government emergency management from three angles: efficiency, information sharing, and emergency actions.

Number of questionnaires collected	Valid responses to the questionnaire	Invalid questionnaire	Effective feedback rate
210	199	11	94.76%

Figure 1: Questionnaire feedback rate statistics table.

The following table contains specific information about the 200 valid questionnaires that were gathered using the Questionnaire Star platform. The information was divided into five categories based on the

sample's basic characteristics: gender, age distribution, education, occupation, and type of unit to which they belonged.

Statistical question items	Statistical description					
Gender	Male	Female				
	109 (54.76%)	90 (45.24%)				
Age	25 or below	26-35	36-45	45 or above		
	73 (36.67%)	80 (40%)	27 (13.81%)	19 (9.52%)		
	Academic level	High school	Vocational	Bachelor	Master	Doctorate
		12 (6.05%)	20 (10.06%)	56 (28.1%)	86 (43.21%)	23 (11.58%)
Occupation	Public servant	Student	Teacher	Others		
	71 (35.67%)	65 (32.66%)	16 (8.04%)	47 (23.62%)		
Workplace	Governmental unit	Academia	Others			
	79 (39.7%)	87 (43.72%)	33 (16.58%)			

Figure 2: Sample Basic Statistics.

Since the bulk of the sample in this study consists of individuals who have either direct or indirect interaction with emergency management, they are content with it. As a result, only 5% of respondents are dissatisfied with the current government emergency management, and 34.12% are. This shows that there are still unfinished emergency management components inside our government, necessitating further investiga-

tion and gap filling in order to correct the errors. Furthermore, the statistical information gathered by the surveyor regarding the emergency management objectives of the government can aid in our comprehension of the disparity between the government's emergency management capabilities and the actual needs, as well as provide direction and guidance for the government's future development and reform priorities

Title	Options	Select number	Percentage of samples
Building objectives of government emergency management work	Improve emergency command and control capability	93	46.73%
	Improving emergency rapid response capability	104	52.26%
	Improving emergency response capability	112	56.78%
	Improving emergency coordination service capability	113	56.78%

Figure 3: Building objectives of government emergency management work.

3 DISCUSSION

The governmental body has established a comprehensive information gathering and dissemination system as the information subject with the tightest division of labor in the information coordination structure. When a public health emergency arises, individuals or units will first report it to local CDCs and medical facilities, which will then relay it to higher-level health administrative departments. Finally, health administrative departments will report the emergency to their provincial governments, which will then decide whether to activate the emergency plan. The original information sources of public health emergencies will be disseminated throughout various agencies and levels of government in this organizational framework. The market, the community, the public, and other players will accept the government's unified deployment and make modifications in accordance with the realities of the situation when the government makes and issues a decision.

Market participants must also participate in addition to government actors. The government can distribute resources in a useful way across the country, but it cannot do so precisely. In order to achieve precise allocation and make up for the lack of government material allocation, market participants can adjust the input and output of necessary materials in accordance with changes in the market's supply and demand. They can also feed back the information after allocation to the market itself, which will be gathered and compiled by the government.

In the coordinated structure of public health emergency communication, social actors can have a significant impact. Some groups are unable to get supplies in accordance with their actual needs due to the market's profit-driven nature, and a shortage of human resources can make it difficult to prevent and treat public health issues. These challenges can be efficiently addressed by the public interest and philanthropic groups that make up the social actors, and the data produced by their actions is given back to the public and gathered by the government.

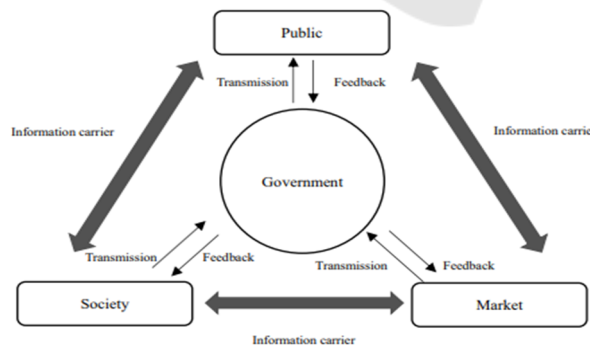


Figure 4: The relationship between publicity, society, market, and the government.

Recovery from public health emergencies is the primary goal of information collaboration during this time. The public, the market, and the government are

the key participants in information coordination throughout this time. After a public health crisis, the

government will set up a damage assessment and information feedback mechanism to track the damage and the population's state of recovery. At this point, the information coordination model will demonstrate that the primary information coordination model subjects are the government, market, and public, while the supplementary information coordination model subjects are the medical and social. The three parties work together to restore social order in this paradigm, with the public serving as the primary participant, the market serving as the executor, and the government serving as the coordinator. The relevant ministries will carry out a thorough analysis of the incident's process and outcomes and update the health incident management database. The government's emergency management centre will analyse the harm caused by the incident, create a report, and submit it to the government. In order to ensure a fair allocation of resources, the market will also revalue commodities based on the current supply and demand situation as well as governmental directives. Through the Internet, the phone, and complaint letters, the public will be able to voice their opinions on the success of the emergency measures.

4 CONCLUSION

China now has a very poor system in place for handling public health emergencies, and it is necessary to reinforce the handling procedures in addition to improving the norms and regulations that apply. At the same time, younger individuals made up the majority of respondents to this case study questionnaire, and the vulnerable older population's sample size was less. Finally, since the questionnaires for this study were gathered in a concentrated period of time, the analysis of cross-sectional data did not fully capture the characteristics of the behavior of the general public in terms of information coordination during public health emergencies, i.e., the impact of changes in the information epidemic on information coordination at various stages of public health emergencies.

REFERENCES

Elmurngi E, Gherbi A. Detecting fake reviews through sentiment analysis using machine learning techniques[J]. IARIA/ data analytics,2017: 65-72.
 He Xin. The study of emergency management synergy mechanism in China's universities [D]. Chengdu: University of Electronic Science and Technology, 2010.

Liang Zhiming. Research on Collaborative Mechanism and System of Emergency Management in Power Logistics [J]. China Economic and Trade Journal, 2014 (8): 59 - 60 .
 Samadi M, Mousavian M, Momtazi S. Deep contextualized text representation and learning for fake news detection[J]. Information Processing & Management,2021,58(6):102723.
 Shu K, Sliva A, Wang S, et al. Fake news detection on social media: A data mining perspective[J].ACM SIGKDD explorations newsletter,2017,19(1): 22-36.
 Qian, S., Wang, J., Hu, J., Fang, Q, et al. Hierarchical multimodal contextual attention network for fake news detection [C]//In Proceedings of the 44th international ACM SIGIR conference on research and development in information retrieval.2021:153-162.
 Xie Jungui. Social synergy issues in disaster crisis management [J]. Journal of Disaster Prevention, 2008, 9(2): 104-108.