Strengthening the Emergency Science Communication Intervention Mechanism to Promote Science and Technology Safeguarding Social Security (Postprint)

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Abstract

In recent years, with the continuous expansion of self-media and cyberspace, social hotspot events involving public safety have exhibited trends of increasing complexity, variability, and frequency. Particularly, hotspot events and emergencies related to science and technology, while stimulating substantial public engagement, have also disrupted the normal order of social life to a certain extent. Integrating science communication into the governance mechanisms of major science and technology hotspot events, and achieving its participation throughout the entire process in a normalized and scientific manner, holds significant importance for ensuring social security and enhancing public understanding of science and technology. This article analyzes the current status of emergency science communication involvement in the governance of science and technology hotspot events in China, starting from the definition and characteristics of major science and technology hotspot events. It constructs a mechanism for science communication involvement from two dimensions—model and timing—providing a reference for joint efforts by government, media, the scientific community, enterprises, and the public to improve the governance of major science and technology hotspot events in China.

Full Text

Abstract

In recent years, with the expansion of social media and cyberspace, social hotspot events have become more complicated, changeable, and frequent, especially some hot events involving science and technology (S&T) have attracted great public participation, and also interfered with the normal social life. Penetrating of science popularization into governance mechanisms of S&T hot events

should be great significance to safeguarding social security and enhancing public understanding of S&T. Based on definition of S&T hot events, this study analyzes the current situation of science popularization intervention, and builds the intervention mechanism from mode and timing, finally provides suggestions for the government, the media, the scientific community, the enterprises, and the public to participate in the promotion of S&T hot events management.

Keywords: science and technology (S&T) hot events, science popularization, intervention mechanism

1. Introduction: Cross-disciplinary Research on Science Popularization and Emergency Events

Integrating science popularization with emergency event management has become a research consensus in recent years, with existing studies primarily focusing on the necessity of science popularization intervention in emergency management and the construction of corresponding mechanisms. However, research remains insufficient regarding the causes, characteristics, and participating actors of S&T hotspot events, as well as the modes and timing of science popularization intervention. Scholars such as Zhu Xiaomin have argued that conducting science popularization in response to public emergencies involving science and technology helps truly center popularization work around the public and integrate it into daily life. Ju Yunfeng contends that contemporary science popularization should align with the times and stay close to society, reality, life, and the masses by focusing on public emergencies to better serve the people. The China Research Institute for Science Popularization has incorporated research on the relationship between science popularization and social hotspots into its annual projects from 2010 to 2013, organizing theoretical and practical studies. Some researchers have also begun exploring perspectives from social management innovation mechanisms. For instance, Xu Wanqiang and Zhang Hongfang argue that science popularization helps guide and standardize the diffusion effects of public emergencies, thereby improving social governance and maintaining normal social order. Tian Yuan conducted an in-depth analysis of major problems in domestic science popularization websites using the Chinese Academy of Sciences' website as a typical case. Liu Yanjun et al. propose that an emergency science popularization mechanism for guiding public opinion in public emergencies constitutes a multi-actor public opinion guidance structure under a unitary power structure comprising media organizations controlling communication technology, providers of scientific information, and science popularization managers. Shi Guojin has explored scientific communication mechanisms in public emergencies, proposing three models: linear communication, systematic communication, and cybernetic communication. Lin Zhaobin addresses the construction of emergency science popularization systems in public emergencies. Fu Pianpian examines media public opinion guidance mechanisms in major emergencies from the perspective of media organizations. Despite these contributions, research on the formation mechanisms, characteristics, and

participating actors of S&T hotspot events, as well as the specific modes and timing of science popularization intervention, remains inadequate. This paper will address these gaps by analyzing concrete cases, starting from the definition and characteristics of major S&T hotspot events, examining the features and demands of participating actors, and systematically analyzing intervention mechanisms from the dual dimensions of mode and timing to provide references for multi-actor collaborative governance.

2. Connotation and Characteristics of Major S&T Hotspot Events

2.1 Connotation

Different types of events may have completely different occurrence and evolution mechanisms. The primary target of science popularization intervention is major S&T hotspot events, whose main characteristic is that science and technology serve as either the source or a key factor in the propagation process. These events involve both relatively neutral hotspot events and emergencies that may cause damage. For instance, in the "Xiamen PX Project Incident," the event evolved from a proposal opposed by 105 national political advisors to a "collective walk" by Xiamen citizens, demonstrating how hotspot events can escalate into emergencies. Conversely, incidents like the "Tsinghua 12 · 18 Laboratory Explosion" show how emergencies can evolve into public concerns about hazardous chemicals. Research on the basic characteristics and evolution mechanisms of major S&T hotspot events is crucial for designing effective intervention mechanisms.

Major S&T hotspot events have two key connotations: First, science and technology serve as the source of the event or a critical factor in its propagation process, meaning the event' s occurrence and evolution are influenced by how communication actors judge scientific facts. Second, the event ultimately evolves into a social hotspot that generates widespread impact and public concern. It is important to emphasize that science popularization for major S&T hotspot events differs fundamentally from traditional emergency science popularization. The latter aims to improve public capacity to respond to social emergencies and natural disasters through relevant scientific and technological dissemination and education, whereas the former focuses on science popularization activities conducted during hotspot event governance processes to quickly mitigate negative impacts.

2.2 Propagation Characteristics

The "PX Project" series of incidents has become a typical sample for social hotspot event governance due to its high social attention, significant negative impact, and high frequency of occurrence. Analyzing these events reveals four main characteristics of major S&T hotspot events:

(1) Extensiveness. Although major S&T hotspot events originate from concerns about the immediate interests of specific groups within a certain timeframe, they often trigger a series of abnormal social reactions. In the "PX Project" series, some local governments' improper handling caused public psychological panic, social disorder, and widespread questioning of values, affecting government image, scientific community reputation, media orientation, and the interests of enterprises and the public. These impacts are not limited to specific social classes or time periods, demonstrating temporal and spatial extensiveness.

(2) Sociality. The outbreak of incidents like the "PX Project" series is often related to the long-term accumulation of deep social contradictions, such as conflicts of corporate interests and land acquisition compensation. Participants include not only those from the epicenter of the social hotspot but also many more from the public who resonate through media coverage. The sociality of the public is mainly manifested in their use of extensive network coverage and freedom to comment and express views, thereby promoting the resolution of social hotspot issues.

(3) Propagability. Science popularization and S&T communication play important roles in the occurrence and evolution of major S&T hotspot events. The public' s basic understanding of scientific facts can be understood as an ideological battlefield where pseudoscience and rumors are direct opponents of science popularization. The emergence of pseudoscience and rumors often occurs in the early stages of hotspot events when the public has not yet obtained sufficient information or established correct understanding, making intervention at this stage particularly critical. Long-term absence of science popularization allows pseudoscience and rumors to run rampant for periods, creating enormous obstacles for later governance.

(4) Complexity. In the "Ningbo PX Project Incident," the event evolved from villagers petitioning over land compensation to a major public environmental sentiment outbreak. The uncertainty of the event' s origin and development creates strong complexity for governance, which in turn places higher demands on the selection of intervention modes and timing for science popularization.

3. Current Status of Emergency Science Popularization Intervention in China

Since the 2003 SARS incident, China has made considerable progress in emergency response for public emergencies and social hotspot events, with many successful experiences in science popularization intervention for major S&T hotspot events. However, as the interactivity, timeliness, and professionalism of S&T hotspot event propagation have gradually strengthened in recent years, three major problems have emerged:

(1) Emphasis on Governance, Neglect of Interaction–Intervention Modes Need to be Adapted to Local Conditions. With continuously improving public enthusiasm and capacity to participate in social hotspot events,

the previous government-dominated intervention model can no longer fully meet governance needs. Multi-actor participation and interaction involving government, media, scientific community, enterprises, and the public have become the trend. Intervention modes must be adapted to local conditions based on the occurrence and evolution mechanisms of different S&T hotspot events, leveraging the government' s information and resource advantages, media' s communication channel advantages, the scientific community' s professional knowledge advantages, enterprises' resource advantages, and the public' s self-media rapid perception and dissemination advantages to efficiently guide public rational participation and acquisition of correct scientific knowledge, thereby quickly controlling negative impacts and enhancing social security.

(2) Emphasis on Emergency Response, Neglect of Prevention–Intervention Timing Needs to be Advanced. The occurrence and evolution of major S&T hotspot events are often accompanied by the propagation of science popularization, pseudo-science popularization, and even rumors. Improper intervention timing or forced responses due to public pressure can cause pseudoscience and rumors to flourish. Prevention before events is more important than emergency response afterward. Currently, China' s risk prevention and control mechanisms for science popularization intervention in hotspot events need improvement. Intervention timing must be advanced by strengthening public opinion monitoring and forecasting for specific event types, grasping the right moment for intervention, and moving the intervention threshold forward to prevent problems before they occur.

(3) Emphasis on Channels, Neglect of Content–Linkages Between Media and Scientific Community Need Strengthening. With the rise of self-media, public access to information has become more convenient. Although traditional media channels can quickly disseminate science popularization content, public demand far exceeds media interpretations of hotspot events. More authoritative interpretations and professional knowledge from scientists and professional institutions are needed. However, China has not yet formed an effective mechanism for the scientific community to respond promptly to S&T hotspot events. While publications like *Science and Technology Review* and Guokr have established columns on "hotspot S&T events"that enhance professionalism, their timeliness needs improvement. Strengthening linkages between media and the scientific community and maximizing the scientific community's active participation in hotspot event science popularization is crucial for enhancing intervention effectiveness.

4. Science Popularization Intervention Mechanisms for Major S&T Hotspot Events

Effective intervention mechanisms must address both organizational-level intervention modes and decision-level intervention timing.

4.1 Intervention Modes

Five distinct intervention modes can be identified based on the dominant actor:

(1) Government-Led Mode. In this mode, the government serves as the organizational manager of S&T information release activities, the scientific community as the direct provider of S&T information, media as the indirect provider, and the public as the ultimate receiver. The government-scientific community relationship is one of information management and production, government-media is direct vs. indirect propagation, and government-public is propagation vs. reception. In the Xiamen PX Project governance process, the Xiamen municipal government organized and released science popularization information about PX' s environmental impact multiple times after national political advisors jointly opposed the project. Although public concerns were not completely eliminated, this provided a foundation for guiding rational public participation in subsequent decision-making. The effectiveness of government-led intervention depends on government credibility and timely, effective intervention.

(2) Media-Led Mode. In this mode, media actively seek independent S&T information sources to provide audiences with a more comprehensive and rich panorama of events. The government propaganda department serves as the macro-guide for S&T communication activities, while media act as both organizers/managers and specific disseminators of S&T information. *Under the Dome* is a typical example of environment-related knowledge popularization based on media interviews. Because it addressed the immediate interests of the broad public and differed from the government-led production and information release model, it triggered enormous public attention in a short time. In this model, media' s social responsibility and value orientation determine their motivation to organize such popularization activities. The government-guided media-led model, especially science popularization activities led by government self-media platforms, will become an important form of intervention in the future.

(3) Scientific Community-Led Mode. In this mode, the scientific community builds communication platforms between scientists and media to guide public rational understanding and response to events. The scientific community serves as the direct provider of S&T information, government as the receiver and user, media as the indirect provider, and the public as the final receiver. In hotspot events like the "gravitational wave" and "Tsinghua 12 · 18 Laboratory Explosion," the scientific community' s timely and proactive voice provided authoritative bases for quelling rumors and resisting pseudo-science, with the scientific community's external media platforms, especially self-media platforms, playing important roles.

(4) Enterprise-Led Mode. Enterprise-led science popularization constitutes an important component of major S&T hotspot event governance. Based on social responsibility and self-interest considerations, enterprises' science popularization activities often achieve rapid results because they address key issues with substantial public relations resources. In the "salt rush" incident, relevant

enterprises timely organized and released rumor-refuting and science popularization information after monitoring social hotspots, and increased iodized salt supply in some regions through market means, effectively controlling negative impacts on the economy and society. However, the accuracy of information in enterprise-led science popularization still requires assistance from the scientific community, and such activities need to be implemented under the supervision of government propaganda departments.

(5) Public-Led Mode. Self-media era public spontaneous science popularization is growing rapidly, with self-media' s science popularization activities in major S&T hotspot events often exerting enormous influence on event evolution. In the "PX Project" series, pseudo-science popularization or rumor information released through self-media became important factors misleading the public and driving event escalation. While public-led science popularization often cannot guarantee accuracy and is difficult to regulate, making it susceptible to exploitation by bad actors, it has outstanding timeliness advantages. If properly guided, it can play important roles in resolving major S&T hotspot events. Encouraging traditional media to develop self-media platforms and conduct responsible science popularization activities will be an important form of public-led intervention.

4.2 Intervention Timing

Intervention timing can be categorized into three critical phases:

(1) Before Events–Intervention in Risk Governance. Pre-event intervention requires strengthening dynamic monitoring of public opinion on hotspot events and timely science popularization intervention on S&T hotspots that may trigger emergencies. This proactive intervention occupies the information dissemination high ground before rumors and pseudo-science can gain scale. The process involves continuously transmitting information about potential hotspot events and their response measures to target audiences through various channels, with government departments as the main actors, content focusing on hotspot event occurrence and response information, channels including traditional media, the internet, and grassroots information transmission, and the target being the general public. The expected outcome is improved public ability to identify and resist rumors.

(2) During Events–Intervention in Emergency Response. During major S&T hotspot events, timely and open science popularization knowledge dissemination by media can block the spread of informal information and help maintain overall social stability. Media attention to hotspot events is both a functional requirement and an inevitable news value choice. Governments need to utilize media for science popularization, allowing media involvement in hotspot event knowledge dissemination as an important prerequisite for forming positive interaction between managers and media. Governments should establish authoritative information channels, maintain authoritative and consistent content to

avoid information confusion, and establish relevant media centers responsible for unified information release based on event development.

(3) After Events–Intervention in Follow-up Work. Post-event psychological intervention and assistance constitute important work in major S&T hotspot event science popularization. Public emergencies cause not only severe damage but also wide-ranging, long-lasting impacts. For victims and their families, uncertainties before and during the event, physical harm and threats, and personal economic losses can cause psychological and physiological distress. Active intervention, guidance, and treatment through science popularization to help those involved in S&T hotspot events navigate periods of mental stress is essential.

5. Recommendations for Improving Intervention Mechanisms

Major S&T hotspot event science popularization requires multi-actor participation and governance involving government, scientific community, enterprises, media, and the public:

(1) Government Participation Throughout All Stages. The government plays different roles at different stages: as an "observer" and "trainer" for the public during the pre-event symptom period; as an information publisher and "coordinator" of various relationships during the event outbreak; and as a "restorer" of damaged government image and public psychology after the event, before returning to the "observer" role. Overall, the government commands the richest social resources, possesses relatively high information integration capacity and efficiency, and has guiding and supervisory responsibilities for other actors' science popularization activities, making it the most important leader in major S&T hotspot event science popularization.

(2) Strengthening Media Roles. Media constitute the primary channel through which major S&T hotspot event information is disseminated and the main source through which the public obtains news. During event outbreaks, media can actively report event progress, conveying government-released information to satisfy public information needs while enhancing their own attention and meeting development needs. Additionally, media should leverage their high social sensitivity to timely identify and proactively conduct science popularization interventions on social hotspots as beneficial supplements to government-led models.

(3) Leveraging Professional Advantages. The scientific community plays an extremely important role in major S&T hotspot event science popularization due to its professional expertise, serving as a crucial assistant. Professional research institutions and universities can become excellent information sources, providing timely, accurate, and authoritative science popularization information for event governance. Strengthening science popularization intermediary

services is also an effective way to establish connections between the scientific community and media.

(4) Guiding Enterprise Participation. Enterprises are important stakeholders in major S&T hotspot events and possess certain science popularization resource advantages in their professional domains. Their participation can mitigate negative impacts on business operations while fulfilling social responsibility and enhancing corporate public image. Guiding enterprise participation requires enterprises to pay more attention to maintaining their social image and improving public acceptance of their involvement in emergency science popularization.

(5) Emphasizing Public Interaction. The public is the primary information receiver in emergency science popularization but not a passive one. The public identifies and selectively receives information about major S&T hotspot events, making it essential to understand public psychology. Strengthening government, media, scientific community, and enterprise understanding of public cognitive psychology and continuously reinforcing public understanding and recognition of science popularization information through full interaction constitutes the foundation for building multi-actor collaborative governance.

6. Conclusion

Establishing and improving the science popularization intervention mechanism for major S&T hotspot events requires leveraging the initiative and advantages of government, media, scientific community, enterprises, and the public. By building a multi-actor collaborative emergency science popularization intervention model and selecting intervention timing based on event characteristics and evolution, we can maximize the role of multiple actors in emergency science popularization for social hotspot events. This will enable effective governance of such events and enhance the overall level of science and technology safeguarding and supporting social security.

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