

Comparative Study on the Dynamic Mechanisms of Information Dissemination in Online Public Opinion: Postprint

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Abstract

[Objective/Significance] The dissemination of online public opinion information constitutes a systematic, dynamic, and complex lifecycle. Research on the dynamic mechanisms of online public opinion information dissemination facilitates a deeper understanding of its complexity and systematic nature. [Method/Process] This study conducts a cluster analysis of relevant literature on online public opinion dynamic mechanisms along two dimensions—internal drivers and external drivers—and performs a comparative analysis of system elements and technical models to construct a comprehensive framework for the dynamic mechanisms of online public opinion information dissemination. [Results/Conclusion] Existing research has analyzed system elements across dimensions including participating entities, event information, carrier platforms, and external environments, and has simulated the formation process of online public opinion through both multi-dimensional factor influence models and single-dimensional factor influence models. By analyzing the interactive gaming processes among various elements of online public opinion, this study synthesizes a modeling procedure for the dynamic mechanisms of online public opinion information dissemination. It is recommended that future research should advance toward the directions of small-world networks, big data, and cloud-based dissemination.

Full Text

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A Comparative Study on the Dynamic Mechanism of Internet Public Opinion Information Communication*

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Abstract: [Purpose/Significance] Internet public opinion information communication represents a systematic, dynamic, and complex lifecycle. Investigating the dynamic mechanisms underlying this process enhances our understanding of its complexity and systematic nature. [Method/Process] This study conducts a cluster analysis of existing literature on the dynamic mechanisms of Internet public opinion along two dimensions—internal and external driving forces—and performs comparative analyses of system elements and technical models to construct a comprehensive framework for the dynamic mechanism of Internet public opinion information communication. [Results/Conclusion] Previous research has examined system elements across dimensions including participating subjects, event information, carrier platforms, and external environments, while simulating the formation process of Internet public opinion through both multi-dimensional and single-dimensional factor influence models. By analyzing the interactive gaming processes among various elements, this paper summarizes the modeling procedures for the dynamic mechanism of Internet public opinion information communication. Future research should advance toward small-world networks, big data, and cloud communication.

Keywords: Internet public opinion; dynamic mechanism; information communication; comparative study

Internet public opinion refers to the information collection of people's cognition, attitudes, emotions, and behavioral tendencies toward events disseminated via the Internet [1]. It constitutes a systematic process in which numerous elements are interrelated and interact collectively, with the dynamic interplay among these components jointly driving the formation and diffusion of online public opinion. To investigate the evolution of network public opinion, it is essential to thoroughly analyze the specific driving forces behind its information dissemination and understand the underlying factors that explain why it emerges, develops, and subsides.

Existing research has examined the dynamic mechanisms of Internet public opinion information communication from various dimensions. Some studies have investigated the information dissemination mechanisms of specific public opinion incidents from the perspectives of different actors, including events, media, netizens, and government [1-2]. Others have explored the driving and resisting mechanisms of public opinion phenomena such as group polarization and political generalization from the standpoint of different power sources [3]. Research in specific subfields has primarily focused on campus public opinion [4], anti-corruption public opinion [5], and environmental pollution public opinion [6-7]. While these studies have deepened our understanding of Internet public opinion transmission mechanisms from different subjects, perspectives, and fields, the diversity of research approaches has resulted in a lack of systematic review, and various studies await academic dialogue, making it difficult to comprehensively reveal the overall dynamic mechanism of Internet public opinion information communication.

Based on an analysis of the elements driving Internet public opinion information

communication, this paper clusters relevant literature and comparatively analyzes both the system elements and technical models of the dynamic mechanism. By comparing the roles and influences of various elements, this study comprehensively explores the power sources and transmission mechanisms of Internet public opinion information communication, presenting a relatively complete picture of its propagation process and demonstrating the complex internal structure of the nonlinear system, thereby providing reference for subsequent research on Internet public opinion communication.

2 Research Design

2.1 Literature Sources and Collection

As this study is not a bibliometric analysis but rather uses representative research to explore the dynamic mechanism of Internet public opinion information communication, the collected samples were selected based on their capacity to support comparative analysis of these mechanisms. We employed two approaches to gather research literature. First, we searched the CNKI database with the following criteria: source journals limited to core and CSSCI journals; time range from 2000 to June 2017; search terms included “power” AND “public opinion” OR “public sentiment” in titles, given that many researchers use system dynamics methods; additional searches used “motivation” AND “public opinion” OR “public sentiment” in titles; to increase sample coverage and enhance conclusion validity, we also searched topics containing “evolution” AND “public opinion” OR “public sentiment” with “power” as a keyword, and topics containing “formation” AND “public opinion” OR “public sentiment” with “power” as a keyword. Second, through snowballing from retrieved literature and manual re-examination, we ultimately selected 45 representative papers on Internet public opinion.

2.2 Clustering of Dynamic Mechanism Research

2.2.1 Classification of System Elements The concept of mechanism originates from structural functionalism and refers to the operational mode that coordinates relationships among various parts of a system to promote overall functional performance based on correct understanding of each component. In short, mechanism emphasizes the organic connections between the whole and its parts. As a unique phenomenon emerging in the social field, Internet public opinion’s formation, development, and evolution are profoundly influenced by the external social environment. Therefore, the dynamic mechanism of Internet public opinion must consider both the internal elements’ impact on the whole and the external environment’s influence on internal operations, as shown in Figure 1 [Figure 1: see original paper].

Accordingly, the driving forces of Internet public opinion information communication are divided into internal and external power based on their sources.

(1) Internal Power of Internet Public Opinion Information Communication. Analyzing the internal driving forces of Internet public opinion evolution begins with identifying its core elements. Public events serve as the trigger for Internet public opinion outbreaks and exert significant influence on its generation and development. Therefore, Internet public opinion information communication represents an interactive information transmission process among subjects concerning public events, particularly sudden public events. Ontologically, the producers of Internet public opinion are the populace, the primary governance body is the government, the object is public events, the carrier is media, and the essence is the information collection of cognition, attitudes, emotions, and behavioral tendencies. Based on this, this study summarizes existing research on internal driving forces along three dimensions: participating subjects (including government and netizens), event information, and carrier platforms.

The mechanism must take the elements constituting public opinion as fundamental dimensions, determine the functional roles and interrelationships of each element, and ultimately construct a model of the dynamic mechanism of public opinion communication. Current scholars of Internet public opinion primarily come from social sciences and computer and information sciences [8], with existing research generally following two approaches: (1) constructing systematic models of Internet public opinion information communication from a social science perspective, and (2) building technical models of Internet public opinion information communication from an engineering perspective.

Furthermore, technical models of Internet public opinion information communication can be divided into multi-dimensional factor influence models and single-dimensional factor influence models based on different dimensional designs. Multi-dimensional factor influence models construct technical models from multiple dimensions including participating subjects, carrier platforms, event information, and external environments, while single-dimensional factor influence models select a specific dimension to build models based on single-dimension elements.

(2) External Power of Internet Public Opinion Information Communication. Although Internet public opinion evolution primarily depends on interactive gaming among internal elements, its emergence and development are also profoundly affected by external macro factors. In fact, while many studies explore the dynamic mechanisms of Internet public opinion from internal factors, they have also begun to examine external environmental factors influencing its evolution. Therefore, this study incorporates the external environment into its analysis to investigate the external driving forces of Internet public opinion information communication.

This study employs cluster analysis methods to organize existing research perspectives on the dynamic mechanism of Internet public opinion information communication according to the distinction between internal and external factors. On this basis, we conduct further comparative analysis of relevant discussions based on the influencing factors of Internet public opinion information com-

munication, aiming to systematically summarize the dynamic mechanism and gradually construct a complete framework.

2.2.2 Classification of Technical Models The dynamic mechanism of Internet public opinion information communication must be modeled by determining system boundaries and key factors. Most existing research categorizes various elements of Internet public opinion through factor analysis and provides technical modeling explanations for the dynamic mechanism. These models generally follow this procedure: analyzing the research object from the internal structure of the public opinion system; defining system boundaries and main elements and drawing causal relationship diagrams; establishing system flow diagrams to display relationships among elements using causal loop diagrams and stock-flow diagrams, describing quantitative relationships with equations, and finally selecting software for simulation. The entire process adopts engineering research flows and methods to build models and conduct simulation based on data, as shown in Figure 2 [Figure 2: see original paper].

3 System Elements of Internet Public Opinion Propagation Dynamics

3.1 Internal Power Dimension

3.1.1 Cognition, Attitude, Emotion, and Behavioral Tendency: Basic Types of Internet Public Opinion Production The populace represents the production 主体 of Internet public opinion, with their cognition of matters, individual attitudes and emotions, and behavioral tendencies serving as the source power for the evolution and development of Internet public opinion. Relevant research summarizes the basic types of Internet public opinion production from four aspects:

- (1) **From the perspective of matter cognition**, public cognitive dissonance and irrational expression constitute positive driving forces for Internet public opinion development [9]. Netizens possess the ability to discover events and sense external environmental stimuli [7,10], driven internally by survival and development needs [11-12]. Influenced by the degree of interest relevance [13] and political quality [14], the populace demonstrates strong interest in sudden public events involving their vital interests, laying the prerequisite for subsequent active participation in Internet public opinion.
- (2) **From the perspective of individual attitude**, Internet public opinion represents the social and political attitudes held by the populace [14]. When facing sudden public events, netizens' dissatisfaction with government mishandling [6], skeptical attitudes [15], and conformist attitudes toward mainstream group opinions [9] further promote the continuous spread and proliferation of Internet public opinion in the social field.

- (3) **From the perspective of individual emotion**, Internet public opinion is significantly affected by emotional mechanisms, showing a one-sided trend [16]. The public's degree of fear [6] and anger [6] accelerate the communication process of Internet public opinion. The sudden exposure of public emergencies strongly stimulates netizens' negative social emotions, triggering group emotional resonance in the public opinion field. Coupled with the interactive influence of emotional infection mechanisms in online clusters [18], this leads to rapid emotional escalation and spread of Internet public opinion in a short time.
- (4) **From the perspective of behavioral tendency**, netizens' expression of emotions and viewpoints promotes public opinion evolution [11], while silence may further trigger public opinion crises [19-20]. Netizens' participation degree [21-23], attention level [24-25], and personal influence [26] also significantly affect the diffusion of Internet public opinion. Netizens' contact rate with information about sudden events, participation level in online discussions, and duration of attention directly influence the diffusion speed, sustained intensity, and destructive scope of Internet public opinion.

Comparative analysis reveals that research on basic types of Internet public opinion production has evolved from conceptual understanding of Internet public opinion itself, with different studies progressing from divergence to consensus. Early research conceptualized Internet public opinion as the social and political attitudes held by the populace toward state managers [14]. Subsequent studies found that Internet public opinion represents a collection of netizens' different emotions, attitudes, and opinions [27]. Further research discovered that Internet public opinion encompasses not only cognition, attitudes, and emotions but also netizens' behavioral tendencies [1]. Overall, these studies adopt both narrow and broad perspectives, with the main difference lying in the conceptual extension of Internet public opinion. The narrow perspective, considering the correlation between public opinion and public sentiment, limits the essence of Internet public opinion to a single entity of opinions and attitudes. The broad perspective expands this essence into a comprehensive combination of cognition, attitudes, emotions, and behavioral tendencies. Netizens' potential behavioral tendencies to participate or remain silent directly determine the final development direction of Internet public opinion [11,19-20]. Current research has gradually reached consensus that the basic types of netizen-produced Internet public opinion have expanded from cognition and attitudes to emotions and behavioral tendencies.

3.1.2 Traditional Media and New Media: Interactive Platforms for Internet Public Opinion Communication Communication media represents an important influencing factor in the evolution of Internet public opinion [21], with media influence serving as a positive driving force for its dissemination [22,28]. Attention and participation from various media directly promote the further escalation of Internet public opinion [5,25]. The benign interaction

between traditional and new media drives the spread and diffusion of Internet public opinion [2]. In the context of media convergence, the development and evolution of Internet public opinion typically manifest as: new media first expose the event, traditional media follow up to expand attention, and the interaction between traditional and online media jointly promotes continuous spread and diffusion.

On one hand, new media has broken the original media landscape and gradually become a powerful promoter of Internet public opinion [29-30]. Reasonable agenda-setting constitutes the primary threshold for curbing the malignant spread of Internet public opinion [3]. When facing various sudden public events, new media, with its open and inclusive characteristics, has become the main information source for the initial exposure of public opinion incidents [28]. The activity level of online media directly affects the public's attention and participation in Internet public opinion [6,30]. Follow-up reports and news quantity from online media further accelerate the diffusion process of Internet public opinion [23]. Particularly, online media platforms such as BBS, social software, and interest groups have endowed netizens with more discourse power to participate in public affairs discussions, functioning as an "amplifier" for Internet public opinion [7].

On the other hand, traditional media still plays an important role in the Internet public opinion market [28]. Due to its advantages in authority, content depth, and agenda-setting, traditional media can achieve scientific guidance of Internet public opinion by influencing key opinion leaders [28]. Therefore, when sudden public opinion incidents emerge, filtering and shielding strategies toward traditional media can effectively block further spread, while traditional media's attention and sustained news coverage promote further dissemination [25]. Consequently, traditional media has become an important carrier for government to achieve temporary public opinion control [31], and enhancing the influence of official mainstream media has become an effective way to control and guide Internet public opinion communication [24].

Research on Internet public opinion interactive platforms primarily compares the influence differences between traditional and new media in Internet public opinion from different media types. Existing research unanimously agrees that media attention and reporting constitute important factors affecting Internet public opinion development [5,25,29-30]. However, different studies also emphasize that the power structure between traditional and new media in Internet public opinion communication is being recombined. Specifically, while emerging media increasingly occupies an important position in Internet public opinion diffusion due to its advantages [7], traditional media still maintains relatively strong credibility and social influence, playing a key role at turning points in Internet public opinion development [28]. Overall, Internet public opinion formation results from interactive communication between traditional and emerging media [2]. However, emerging media's influence in Internet public opinion communication is gradually increasing while traditional media's influ-

ence is relatively weakening [28]. In short, existing research acknowledges that both traditional and emerging media exert significant influence on Internet public opinion, though their relative influence magnitudes differ.

3.1.3 Publicity and Sensitivity: Information Attributes of Internet Public Opinion Events Public opinion incidents serve as the trigger for Internet public opinion generation [29]. From the formation path perspective, Internet public opinion undergoes a “stimulus-response” development process [3], with sudden public events as the stimulus source directly initiating the generation and evolution chain of Internet public opinion. Therefore, the nature and characteristics of events themselves significantly influence subsequent public opinion development.

Overall, the publicity and sensitivity of sudden events constitute the basic attributes that trigger Internet public opinion [15,32]. In general, the practical root of Internet public opinion formation lies in sudden events, whose stimulative nature positively influences public opinion escalation [28]. In reality, stimulativeness is closely linked to sensitivity—the higher the sensitivity of sudden events, the greater their psychological and emotional impact on netizens, thus stimulativeness manifests as sensitivity. Additionally, event attention level, influence, and public interest relevance significantly affect public opinion heat [2]. The higher the relevance of sudden events to the masses’ interests, the higher their publicity and sensitivity. Higher public attention leads to greater event influence, ultimately triggering large-scale spread and proliferation of Internet public opinion.

Further comparative analysis reveals that research on event information of Internet public opinion primarily compares the different status and functions of various attribute characteristics of sudden public events in Internet public opinion communication. Most existing research agrees that Internet public opinion itself follows a “stimulus-response” development chain triggered by sudden public events [3,14]. However, these studies differ in their understanding of different attributes’ positions in this chain. On one hand, only socially sensitive events can attract netizens’ active attention and participation in social discussions within the public opinion field [15]. On the other hand, publicity affects the level and scope of public attention, with more publicly relevant trigger events more easily accelerating Internet public opinion diffusion and spread [32]. The former views event sensitivity as the primary factor mobilizing public participation, while the latter highlights publicity’s fundamental position. In short, although existing research agrees that publicity and sensitivity are two essential attributes of public opinion event information, different studies have not reached complete consensus on these attributes’ relative importance.

3.1.4 Guidance and Control: Government Governance Logic in Responding to Internet Public Opinion As the primary subject of social governance, government influence on Internet public opinion evolution runs

throughout the entire process [2]. Government behavior is the decisive factor in the diffusion and subsidence of Internet public opinion [21], with crisis response intensity [7,33] and response strategies [23,28] significantly affecting development trends. Existing research reveals two main governance paths: (1) addressing problems by adopting a positive stance to respond to public concerns about sudden public events, thereby guiding public opinion to gradually and naturally subside; (2) maintaining social stability by adopting administrative interventions to control and restrain online opinion expression, creating an appearance of public opinion dissipation in a short time.

Along these two different paths, government measures for responding to Internet public opinion show significant differences. On one hand, following the guidance logic, governments can effectively reduce Internet public opinion heat by increasing participation [18], ensuring timely disclosure of authoritative information [24], enhancing emergency response capabilities [18], and positively addressing social concerns, thereby laying a good foundation for subsequent governance. Government credibility building is also crucial, as good credibility can effectively enhance the positive effects of government responses [15].

On the other hand, following the control priority logic, governments should establish emergency response plans for Internet public opinion, strengthen software and hardware facilities, and thereby improve emergency response capabilities for sudden public events that trigger Internet public opinion [33], seizing the initiative in governance at the first moment of outbreak. After eruption, government network supervision and management can effectively curb the spread of false information such as rumors [3], while insufficient official response capacity promotes the derivation of secondary public opinion [34]. In summary, effective supervision and management can prevent Internet public opinion from developing into malignant group polarization and actively guide it toward healthy development.

Comparatively, research on government response to Internet public opinion examines the differences in governance measures based on control and guidance perspectives. Existing research emphasizes that government emergency response capabilities directly determine the final development direction of Internet public opinion [7,23,28,33]. However, studies differ significantly in specific measures. Some argue that governments at all levels should effectively curb malignant spread through network supervision [3], administrative penalties [6], and strong control [32,35]. Others, guided by the guidance logic, emphasize that governments should channel emotions positively, avoid excessively stimulating reasonable expression of online public will [2], rely on information disclosure and credibility [29], and reduce destructive effects through timely release of government news [23]. Overall, different studies follow two distinct governance logics, providing significantly different strategies—crisis public relations perspective focusing on short-term effects and controlling diffusion scope versus social governance perspective emphasizing long-term effects and gradually mitigating major social risks.

3.2 External Power Dimension—Real and Virtual Environments: Two Types of External Environments for Internet Public Opinion

The macro social environment, as the external objective background, exerts an inherent influence on the generation and development of Internet public opinion. Social environments include real and virtual environments: real environments refer to social environments constructed by objective social factors, while virtual environments refer to the external information environment and group opinion environment perceived by netizens in Internet communication.

On one hand, Internet public opinion communication is significantly affected by social objective factors [5]. Harmonious and inclusive political, economic, social, and cultural environments can promote social integration, resolve social contradictions, maintain social stability, and drive sustainable and healthy social development. Current transitional China experiences local social injustice, livelihood issues, and other practical contradictions, with money worship and hedonism prevailing, providing fertile ground for Internet public opinion [28]. Exposure of sudden public events can easily stimulate high attention and sustained discussion among the masses in a short time, thereby facilitating the formation and escalation of Internet public opinion.

On the other hand, Internet public opinion is also constrained by the external environment of social networks [36]. The virtual environment created by the Internet can easily lead netizens to experience group polarization under the influence of group infection and conformity psychology, affected by opinion leaders. Group norm factors such as relationship strength and leader influence affect netizens' participation behavior [26]. Under group consistency pressure, individual netizens easily submit to dominant opinions, causing Internet public opinion heat to continuously rise [6,25]. Especially when participating in discussions about sudden events, netizens catalyzed by anger, dissatisfaction, and resentment prevalent in the virtual environment lead to a sharp increase in irrational expression. Under the influence of negative emotions, Internet public opinion can easily develop toward negative and extreme directions, ultimately evolving into widely influential and highly destructive Internet public opinion crisis events.

Comparatively, research on the external environment of Internet public opinion examines the differences in influence stages between social objective factors [5] and group norm factors [6,25] from sociological and group psychological perspectives. Some studies, from a sociological perspective, place Internet public opinion within the macro social context, arguing that social injustice and wealth gaps in the real environment constitute realistic roots for Internet public opinion [26]. Others, from a group psychology perspective, view the formation process as a microscopic group psychological evolution, emphasizing the role of netizens' conformity psychology under group consistency pressure [25]. The former seeks the formation roots of Internet public opinion from social structural contradictions, emphasizing that the external environment begins influencing from the

incubation stage, while the latter explores development trends from group psychological operations, arguing that external environmental influence gradually emerges during the development stage. In short, existing research emphasizes the important impact of external environments but differs significantly on the specific stages of influence.

4 Technical Models of Internet Public Opinion Propagation Dynamics

Constructing technical models of Internet public opinion propagation dynamics requires determining model boundaries and key factors. Most existing research categorizes elements of Internet public opinion through factor analysis and provides technical modeling explanations. These models generally follow this procedure: analyzing the research object from the internal structure of the public opinion system; defining system boundaries and main elements and drawing causal relationship diagrams; establishing system flow diagrams to display relationships among elements, describing quantitative relationships with equations, and finally selecting software for simulation. The entire process adopts engineering research flows and methods, as shown in Figure 2 [Figure 2: see original paper].

4.1 Multi-Dimensional Factor Influence Models of Internet Public Opinion

Multi-dimensional modeling primarily examines the influence models of specific elements within each dimension from four perspectives: participating subjects, carrier platforms, event information, and external environments. Research objects include public opinion evolution and diffusion, risk early warning, and guidance. Internet public opinion results from dynamic interaction and organic coupling among four modules: public opinion information, subjects, media, and audiences. One study built upon Shannon and DeFleur's information transmission model, using the classic Cobb-Douglas production function to construct a system stock-flow diagram of Internet public opinion risk containing variables such as information diffusion efficiency, subject transmission capacity, online media effect level, and audience resonance [22]. Another study, based on Lewin's dynamic field theory, established an algorithm model for Internet anti-corruption public opinion using individual subjective factors, social objective factors, and behavioral coefficients, then used the NetLogo platform for simulation and Baidu Index for model validation. The study found four evolution patterns—inhibited, silent, transitional, and explosive—and emphasized that timely government intervention significantly improves netizen participation in anti-corruption [5].

User personality, other users, and the external environment also significantly influence Internet public opinion information communication. Using cellular automata models combined with user personality, studies have explored infor-

mation free diffusion mechanisms and public opinion intervention mechanisms in social networks. Research found that without intervention, public opinion shows free diffusion with initially fast then slowing transmission rates until reaching all network nodes; with strong intervention, the influence scope decreases rapidly, achieving significant intervention effects [36]. Additionally, Internet public opinion heat is interactively affected by four variables: traditional media attention, netizen participation, netizen satisfaction with government, and online news media attention. Based on game theory and using the analytic hierarchy process to determine variable weights, studies constructed calculation formulas for Internet public opinion heat, finding that timely determination of event explosiveness, improved government credibility, and enhanced event handling capacity significantly control public opinion heat [25].

Given that Internet public opinion manifests as interpersonal interaction among individual netizens, studies have used small-world network models and computer simulation to establish evolution models. One study built interpersonal network topology based on the small-world model, set specific interaction rules among individual netizens, and examined the combined effects of internal psychological factors and external media environments [37]. Another analyzed interpersonal communication processes under new media popularization conditions, finding that netizens no longer rely on traditional media supervision but instead use new media to spread rapidly through interpersonal communication, ultimately forming network public opinion with specific emotional tendencies [38]. Since the small-world network model is essentially an interpersonal network model, these studies focus on interpersonal interaction among netizens but fail to examine other influencing factors beyond netizens and media.

Additionally, considering factors such as event word frequency, information posting quantity, and reply quantity, studies have established prediction models for sudden public crisis events focusing on information posting quantity [39]. Combining empirical and mathematical prediction methods significantly improves prediction accuracy. Based on grey correlation models and examining topic quantity and dissemination platforms, studies have constructed logistic models for predicting Internet public opinion heat [40]. By defining maximum correlation vectors, these studies identify specific factors affecting heat and ensure model scientificity. Some argue that individual viewpoint decisions in Internet public opinion result from the combined effects of expected traction force and group consistency pressure. Based on the Deffuant model, studies have established public opinion evolution dynamics models based on decision deviation, showing that under group consistency pressure, individuals actively choose to conform to group opinions, causing expressed viewpoints to deviate from personal expectations [20]. This model better explains the evolution process in complex social networks compared to classic bounded confidence models.

Besides commonly used cellular automata models, studies based on improved Deffuant models and small-world network structures have found that larger group scale leads to longer time for viewpoint unification, while increased node

degree and rewiring probability significantly reduce convergence time [45]. However, these studies only consider a few variables such as group scale and node degree, failing to comprehensively reflect interpersonal communication and opinion formation processes in Internet public opinion.

4.2 Single-Dimensional Factor Influence Models of Internet Public Opinion

Single-dimensional modeling primarily focuses on specific elements within the netizen perspective of the participating subject dimension, constructing netizen-centered Internet public opinion information transmission models based on cellular automata. Research objects mainly include Internet public opinion evolution and transmission.

Some studies examine the influence coefficient of a single factor on transmission rates. Based on incomplete information dynamic game theory and cellular automata models, one study established an influence model of individual influence on Internet public opinion transmission effects, finding that larger netizen influence coefficients lead to faster information spread, with transmission effects depending on information recipients' affected coefficients [26]. Further research using game theory models and Vensim Ple simulation found that event harm degree and influence, netizen group intensification, traditional and online media reporting frequency, and government response efficiency jointly affect Internet public opinion transmission [41]. Another study, based on the traditional SEIR infectious disease model, established a netizen public opinion forwarding behavior model from the perspectives of user influence and interest, finding that user interest in topics and personal influence expand transmission scope [13].

Other studies have established public opinion evolution models based on multi-Agent complex networks from variables such as stubbornness, trust, and influence. NetLogo platform simulation revealed that due to netizen stubbornness, strong propaganda fails to achieve expected intervention effects, while progressive propaganda using gentle, gradual strategies achieves good results in guiding public opinion [42]. Studies modeling netizen viewpoint stubbornness and personal tendency using cellular automata and Matlab simulation found that netizens gradually form dominant opinions under personal tendency influence during group discussions, while stubborn netizens adhere to disadvantageous opinions, ultimately forming public opinion polarization [43].

Additionally, based on cellular automata models examining netizen viewpoint proportions and silence thresholds, Matlab simulation revealed that dominant opinions continuously rise while disadvantageous opinions gradually silence during evolution, driving public opinion escalation [19]. Subsequent studies using cellular automata models to simulate netizens' free movement and mutual influence in cyberspace designed calculation formulas for majority rules examining cell firmness and cell movement traversal algorithms. Simulation results show that netizens' initial opinions on public affairs exhibit diversified distribution,

with some similar viewpoints converging through multiple iterations and eventually developing into Internet public opinion [44]. By changing cell tendency aggregation, intensity, peak values, and mode tendency, this model better approximates real transmission processes. Apart from cellular automata models, studies using improved Deffuant models and small-world network structures to simulate interpersonal networks found that larger group scale leads to longer viewpoint unification time, while increased node degree and rewiring probability significantly reduce convergence time [45]. However, these studies only consider a few variables and fail to comprehensively reflect interpersonal communication and opinion formation.

4.3 Comparative Analysis of Internet Public Opinion Technical Models

Technical model research on Internet public opinion information communication primarily examines specific influencing factors from the perspective of system elements. Overall, both types of technical models follow the basic logic from factor analysis to model construction, differing only in specific dimensions examined. Multi-dimensional factor influence models use participating subjects, carrier platforms, event information, and external environments as basic dimensions [5,20,22], relatively completely displaying interrelationships and influences among elements in public opinion development to establish overall dynamic mechanisms. Single-dimensional factor influence models select netizen personality traits as specific influencing variables [13,19,26,44], focusing on the impact of netizen personality on overall transmission and emphasizing netizens' important position as participating subjects.

Based on cluster analysis of the two technical model types, comparative research finds that technical model studies essentially select key influencing factors from different dimensions and use technical means to simulate transmission and diffusion processes. However, existing research shows different emphases on various dimensions. Most studies concentrate on examining the prominent role of internal factors [25,36,41-43], while relatively few examine the important influence of external environmental factors [5,20,22]. Specifically, existing research focuses on internal factors such as netizen personality [13,42,44], media attention [25,41], and government intervention [36], while the role of external factors such as group pressure [19-20], group scale [45], and social objective factors [5] requires deeper exploration. In short, both multi-dimensional and single-dimensional factor influence models deeply examine influencing factors from specific dimensions, but different studies show varying degrees of attention to internal versus external factors.

5 Conclusions and Outlook

This paper systematically reviews existing research on Internet public opinion propagation dynamics, conducting cluster analysis of system elements along

internal and external power dimensions and comparing different types of simulation models. The study argues that the interactive gaming among various elements of Internet public opinion forms its information transmission dynamic mechanism. The complete process should be: when trigger events with publicity and sensitivity emerge, netizens, media, and government in the social environment engage in interactive gaming, jointly promoting rapid formation and widespread dissemination of Internet public opinion. In this process, netizens produce Internet public opinion from dimensions of cognition, attitude, emotion, and behavioral tendency and disseminate it through interactive platforms such as traditional and new media; government responds following guidance and control logics; real and virtual environments continuously influence public opinion. In summary, the dynamic mechanism of Internet public opinion information communication is a complex open system where internal and external elements coordinate and interact.

Existing research on Internet public opinion dynamic mechanisms has produced abundant results but also shows deficiencies: (1) **Insufficient holistic consideration of elements**: Most research targets specific types of Internet public opinion, with scattered and fragmented influencing factors. Analysis of internal driving forces is extensive, while external driving forces receive less attention, and the mechanisms by which external forces drive Internet public opinion communication require further study. (2) **Lack of diachronic examination**: Most research adopts a synchronic perspective, analyzing influencing factors and mechanisms holistically, but lacks stage-based analysis of dynamic mechanisms, hindering construction of a complete chain. (3) **Relatively monotonous modeling**: Current modeling research is often limited to a few models such as Agent, SIR, cellular automata, and game theory-based models, mostly using limited sample data and platforms like Vensim Ple and NetLogo for technical verification, awaiting expansion and deepening with big data.

Future research on Internet public opinion dynamic mechanisms should closely follow the development trend of “small world, big data, and cloud communication” to advance the field. Regarding **small world**: Although the small-world model is mature, existing research mostly transplants technology while neglecting the characteristics of Chinese public opinion and differences between domestic and foreign netizens, requiring better integration of technology and national conditions to align with Chinese social reality. Regarding **big data**: Existing research faces limitations in data mining due to practical and technical constraints, often using case studies with limited generalizability. Future research should strengthen big data collection, analysis, mining, and sharing to explore new transmission mechanisms. Notably, big data is not equivalent to massive online data but represents a coupling set of data from nature, human society, and virtual space [46]. Internet public opinion research must break through network data limitations to organically combine online data, social behavior data, and natural data, constructing a three-dimensional information collection that explains people’s cognition, attitudes, emotions, and behavioral tendencies toward events, thereby multi-dimensionally, real-time, and authentically restoring

the natural state of Internet public opinion. Regarding **cloud communication**: As a new mechanism for people to transmit and share information [47], cloud communication can better explain public opinion communication laws and predict development trends. Future research should strengthen the application of cloud computing technology in information transmission processes.

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A Comparative Study on the Dynamic Mechanism of Internet Public Opinion Information Communication

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Abstract: [Purpose/significance] Internet public opinion information communication is a systematic, dynamic, and complex lifecycle. Studying its dynamic mechanism helps better understand its complexity and systematic nature. [Method/process] This research clusters relevant literature according to internal and external power dimensions, conducts comparative analysis of system elements and technical models, and constructs a complete framework for the dynamic mechanism of Internet public opinion information communication. [Result/conclusion] Existing research analyzes system elements around dimensions such as participating subjects, event information, carrier platforms, and external environments, and simulates formation processes through multi-dimensional

and single-dimensional factor influence models. By analyzing the interactive gaming processes among elements, this study summarizes the modeling process for the dynamic mechanism and suggests future directions toward small-world networks, big data, and cloud communication.

Keywords: Internet public opinion; dynamic mechanism; information communication; comparative study

Note: Figure translations are in progress. See original paper for figures.

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