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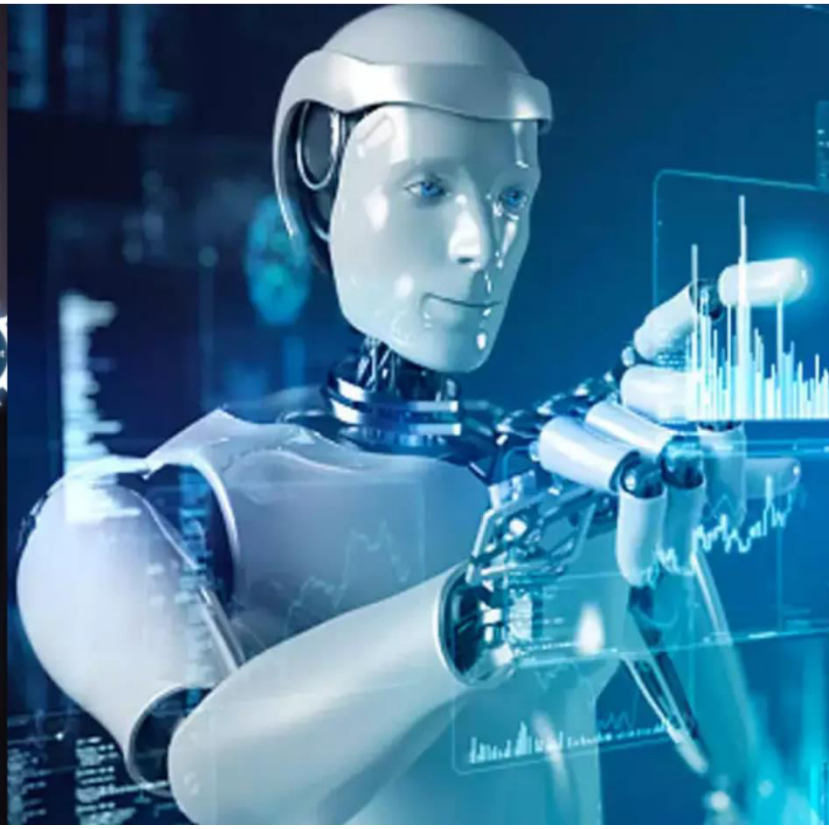

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Exploring the Impact Mechanism of Food Safety Information Asymmetry on Public Risk Perception and Behavioural Response

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ABSTRACT: Food safety information asymmetry has become a critical factor influencing public risk perception and behavioural response in the evolving risk society. This study constructs an integrated analytical framework encompassing "information asymmetry — risk perception — behavioural response — governance optimization," and systematically examines the mechanisms through which incomplete, delayed, or distorted food safety information affects public cognition, emotion, and actions. By synthesizing 21 high-quality domestic and international studies, the research reveals that information asymmetry leads to risk amplification, trust collapse, and behavioural polarization among the public, especially in the context of digital media and fragmented information environments. The study identifies three major pathways of influence—cognitive, emotional, and institutional—and further proposes a multidimensional governance model involving institutional optimization, corporate information disclosure, digital risk early warning, and public participation enhancement. This research provides theoretical insight and practical implications for the modernization of China's food safety governance system and the construction of a trust-based social co-governance network.

KEYWORDS: Food Safety; Information Asymmetry; Risk Perception; Behavioural Response; Trust Mechanism; Risk Communication; Co-governance; Digital Governance

I. INTRODUCTION

1.1 Research Background and Significance

Food safety is a fundamental issue in the field of public health and is closely linked to national well-being and people's livelihoods. In the context of rapid urbanization and industrial restructuring in China, the food supply chain has become increasingly extended and complex. Coupled with biological, chemical, and anthropogenic risk factors, the emergence, accumulation, and outbreak of food safety risks have become more uncertain and socially sensitive [1]. Particularly in today's digital and platform-based consumption environment, the rapid dissemination of information has led to public risk perception structures characterized by "expansiveness," "interconnectivity," and "differentiation." This not only exacerbates the food safety trust crisis but also poses greater challenges to governmental governance [2].

As risk society continues to evolve, the public's cognition, trust, and behavioral responses to food safety incidents have become key elements in building a social co-governance system for food safety. Studies have shown that public risk perception is not entirely based on objective facts, but is rather shaped through a combination of media reports, social networks, and emotional influences under conditions of information asymmetry [3][4]. When food safety information is incomplete, delayed, or distorted, it can easily trigger chain reactions such as panic buying, trust collapse, and escalation of rights protection behaviors, thereby hindering governance effectiveness.

Therefore, clarifying how food safety information asymmetry affects public risk perception and subsequently induces behavioral responses is of significant theoretical and practical value. It helps to understand the difficulties in China's food safety governance, improve risk communication mechanisms, and optimize institutional design [5][6].

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1.2 Research Status at Home and Abroad

At the theoretical level, existing studies have analyzed the mechanisms of risk communication and trust construction from the perspectives of risk communication systems [5][6], social co-governance structures [7], consumer behavior [8][9], and corporate information disclosure mechanisms [10][11]. Institutionally, the EU's food safety risk communication system emphasizes multi-stakeholder participation, independent assessment, and efficient collaboration, thereby establishing a co-governance model that integrates science and democracy [6]. In contrast, China's system still faces issues such as fragmentation and imbalance of responsibilities and powers, with underdeveloped public participation channels and communication mechanisms [5].

In terms of public behavior, consumer participation in food safety incident responses remains generally low [8]. Their decision-making is influenced by a combination of factors, including risk perception, trust levels, and social norms [3][7]. Empirical studies using structural equation modeling have further revealed that trust in risk management significantly suppresses negative emotions among the public, and that positive perceptions can mediate participation intentions [9].

Some studies have also focused on the corporate level, exploring the relationship between managerial characteristics and the quality of information disclosure. It has been found that the academic capital and institutional environment of CEOs can significantly enhance the transparency of food safety information [10][11]. On this basis, trust mechanisms and technological systems (such as blockchain) have been proposed as innovative governance approaches to alleviate public doubts and convey truthful information [12].

However, there is still a lack of systematic research in China that follows the logical chain of "information asymmetry — risk perception — behavioral response," especially studies that integrate institutional design, social trust, and individual psychological factors to explain the cognitive evolution and behavioral logic of the public under information-constrained conditions.

1.3 Research Questions and Innovations

This study focuses on the core issue of "the impact mechanism of food safety information asymmetry on public risk perception and behavioral response," aiming to answer the following three sub-questions:

• First, in what aspects does food safety information asymmetry manifest in China? What specific impacts does it have on public cognition and emotion?

• Second, under what conditions does public risk perception translate into actions such as rights protection, trust rebuilding, or risk avoidance? What are the mediating variables?

• Third, under the context of information asymmetry, how can institutional optimization, technological intervention, and social co-governance alleviate cognitive biases, reduce behavioral risks, and enhance public trust?

Theoretically, this study innovatively integrates the three-stage logic of "risk communication system — construction of risk perception — behavioral response pathway," and attempts to construct an impact mechanism model covering structural variables (information supply, institutional environment), process variables (trust, perception, emotion), and outcome variables (behavioral performance). Methodologically, based on a systematic qualitative analysis of 21 high-quality academic papers, this study proposes governance optimization suggestions adapted to the Chinese context, thereby filling the existing research gap in mechanisms and structural coupling.

II. THEORETICAL FOUNDATIONS AND CONCEPTUAL DEFINITIONS

2.1 The Connotation and Manifestations of Food Safety Information Asymmetry

Information asymmetry, as a classical paradigm in institutional economics, refers to the imbalance in decision-making capability caused by unequal access to information between transaction parties. When introduced into the field of food safety, it is manifested in the asymmetry among regulatory authorities, producers, media, and consumers in terms of information acquisition, processing, disclosure, and interpretation. This structural imbalance often becomes the root cause of public misjudgment regarding food safety conditions.

In the real-world context, China's food industry is characterized by a large population, dispersed operators, and complex supply-demand chains. Furthermore, the transparency of data related to food safety standards, sample

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inspection results, regulatory penalties, and product recalls remains insufficient, which sustains the information gap among governments, enterprises, and consumers [17]. Meanwhile, issues such as fragmented regulation and data silos further weaken public trust and accessibility to disclosed information [5][15]. Therefore, food safety information asymmetry is not only the root of governance difficulties but also directly constrains the public's ability to assess and respond to risks.

2.2 Theoretical Origins of Risk Perception and Behavioral Response

Risk perception refers to an individual's evaluation and judgment of potential external risks based on subjective cognition and emotional experiences, and it is inherently a socially constructed concept. In the food safety domain, such perceptions are influenced by both objective risks (e.g., toxins, additives, pollutants) and distorted by information sources, social trust, and past experiences, forming a cognitive chain of "rationality—emotion—behavior" [3][4].

From the perspectives of risk society theory and the social amplification of risk theory, researchers have pointed out that information transmission media, particularly virtual communities, play a critical role in amplifying public risk perceptions and triggering collective anxiety [4][18]. Related studies have found that the more actively individuals engage in virtual communities, the more likely they are to perceive food as "unsafe," even leading to risk overestimation beyond the objective reality [4]. Furthermore, political trust and perceived government performance have been shown to exert "shielding" and "buffering" effects in this mechanism, suggesting that the structure of information trust significantly mediates risk perception [4][7].

On the behavioral level, risk perception can translate into various responses such as supervision participation, information sharing, complaint filing, and panic-driven avoidance [8][13][19]. For instance, consumers under conditions of incomplete information tend to revert to symbolic cognition such as "organic" or "handmade" food, forming consumption logic driven by "risk avoidance" [19]. However, such logic is often manipulated by marketing discourse, leading to a new "trap of consumerism."

Additionally, whether the public trusts the sources of food safety information significantly affects their levels of negative emotion and willingness to participate. Structural equation modeling results demonstrate that both motivational and competency trust in government sampling inspections can significantly reduce negative emotions and improve public acceptance of regulatory systems [9].

2.3 Evolutionary Characteristics of Food Safety Risk Governance in China

At the macro level, food safety risk governance has become an important indicator of the modernization of national governance capacity. China's food safety risk evolution path exhibits distinctive characteristics of being phased, institutionalized, and complex, with a developmental logic of "high starting point, rapid evolution, and high cost" [1][2].

Studies indicate that the emergence of food safety risks is not only influenced by natural factors such as biological, chemical, and physical elements, but also driven by institutional deficiencies, profit-seeking behaviors of enterprises, and lagging regulation. These risks are transmitted directly or indirectly along the production–distribution–consumption chain and can escalate into systemic crises if not effectively intervened upon [1].

Based on longitudinal observations of food safety risk evolution in different periods, some scholars have proposed the "Food Safety Kuznets Hypothesis," which posits that as economic development increases, food safety risks exhibit an inverted U-shaped curve—accumulating most severely during the middle-income stage, and gradually declining through improved governance capacity, technological reinforcement, and regulatory enhancement [2].

From the governance system perspective, China is progressively transitioning towards a multi-stakeholder governance structure involving the government, market, and society. However, the effectiveness of such co-governance is still constrained by issues such as information asymmetry, low public trust, and lack of coordination mechanisms [6][7]. Thus, building a food safety governance model that can both dismantle information barriers and strengthen public participation and institutional synergy is crucial to achieving the modernization of the governance system.

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III. MECHANISMS BY WHICH INFORMATION ASYMMETRY INFLUENCES PUBLIC FOOD SAFETY RISK PERCEPTION

3.1 Risk Communication Systems and Imbalanced Information Transmission

The core of food safety risk communication systems lies in information exchange and trust building among multiple actors. However, in reality, systemic imbalances in information transmission often distort public cognition. China's current risk communication mechanism remains government-led and is marked by overlapping responsibilities among departments, prominent information silos, and insufficient social collaboration [5]. The "fragmented" and "hierarchical" nature of risk communication results in a lack of horizontal coordination and vertical transparency, causing risk information to be diluted or distorted by the time it reaches the public.

In contrast, the European Union's experience demonstrates a risk communication system supported by independent regulatory bodies and social co-governance frameworks, forming a dynamic closed-loop process of "scientific assessment—information sharing—public collaboration" [6]. This institutional advantage is evident in three aspects: First, a unified organizational management structure ensures consistency in information sources; second, multi-stakeholder participation enhances transparency and the richness of feedback channels; third, scientific assessment mechanisms provide a more objective and rational basis for public trust. In comparison, China's institutional framework still reflects significant disparities in stakeholder status and uneven distribution of information power. The public, being in a relatively weak position within the communication chain, struggles to make accurate cognitive judgments.

3.2 Quality of Information Disclosure and Consumer Risk Perception

Information disclosure serves as a vital mechanism for mitigating information asymmetry, and its role is especially critical in the food industry. Whether enterprises are willing to disclose food safety-related information—and how they do so—directly affects public risk judgments and levels of trust. Research indicates that managerial characteristics significantly influence the quality of food safety information disclosure: executives with academic backgrounds or overseas experience are more inclined to publicize strategic visions and strengthen transparency [10][11]. A favorable institutional environment and reputational pressure further improve the authenticity and completeness of disclosed information, thereby reducing consumer uncertainty and anxiety.

However, if corporate disclosure is superficial or selectively curated, it may amplify the effects of information asymmetry and lead the public to question the effectiveness of food safety regulation. Such cognitive bias not only erodes consumer trust but may also trigger overreactions and intensify public opinion. Therefore, improving the quality of enterprise-level information disclosure is not just a matter of regulatory compliance but a critical control point in the broader social risk transmission chain.

3.3 Amplification Effects of Networks and Virtual Communities

In the digital age, the social dissemination of food safety risks increasingly occurs through online platforms and social media, with impacts far exceeding those of traditional media. In virtual communities, information spreads rapidly and emotional contagion is strong, easily creating "risk resonance" and "emotional diffusion." Studies show that participation in virtual communities significantly increases the perceived probability of food being "unsafe" among rural residents (direct effect = 0.2734), with the effect being especially pronounced among women and high-income groups [4]. This suggests that the openness of information channels does not necessarily promote rational risk perception but may, in fact, intensify fear and distrust within fragmented information environments.

Furthermore, the emotional evolution of public opinion during food safety incidents often follows a phased trajectory: shifting from negative anxiety to neutrality, and eventually toward rationality [18]. However, in the absence of effective guidance and public opinion management mechanisms, negative emotions in online spaces may resonate with media attention and further amplify risk perception. Empirical research indicates that the integrated use of technological, psychological, and legal tools for public opinion guidance can effectively stabilize emotional fluctuations and restore information trust [18].

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Hence, virtual communities act both as amplifiers and potential mitigators of food safety risks. Government agencies and media organizations should intervene through technological tools and psychological guidance to facilitate a shift from "emotional contagion" to "rational dialogue."

3.4 Whistleblowers and the Role of Reporting Systems in Risk Information Supply

In highly asymmetric food safety systems, how to incentivize social individuals and internal personnel to provide truthful and effective information is key to improving overall risk transparency. Reporting mechanisms and whistleblower systems are seen as important supplements for breaking information monopolies. However, studies have found that current reward-based reporting systems suffer from low credibility, inadequate incentives, and limited information utilization, making them underwhelming in practice despite theoretical appeal [17]. From a "structure-process-function" perspective, the failure of such systems stems from flawed contractual design and the absence of feedback loops for reported information.

In contrast, whistleblower systems enable internal risk information transmission and early intervention through internal reporting and protection mechanisms [16]. Their core value lies in prioritizing public interest, aligning incentives, and facilitating rational supervision. By adopting principles of good faith and appropriate incentives, such systems can significantly enhance early warning capabilities and social trust levels in food safety governance. Nevertheless, implementation must carefully balance potential misuse, information leaks, and concerns about social stability.

In summary, information asymmetry shapes public food safety risk perception through multiple pathways—deficiencies in institutional design, biases in corporate disclosure, amplification by media, and inadequacies in whistleblower incentives. Public misperception of food risk is not merely an emotional reaction but a systemic reflection of internal information loss and trust rupture within the governance structure.

IV. PATHWAYS FROM RISK PERCEPTION TO PUBLIC BEHAVIOURAL RESPONSE

4.1 Rights-Protection Behaviour and Public Participation Enthusiasm

Under conditions of information asymmetry, public risk perception regarding food safety directly influences behavioral intentions and modes of participation. Research indicates that the overall level of consumer rights-protection behavior in food safety co-governance is relatively low, with an average score of only 16.26 out of 40, reflecting a pronounced gap between "awareness" and "action" [8]. Gender, education level, and urban-rural differences significantly impact rights-protection enthusiasm—individuals with higher education levels and urban residents are more likely to actively participate in governance affairs. This suggests that knowledge and access to information are prerequisites for behavioral transformation.

On the other hand, risk perception has a significant positive effect on participation intentions. Based on the extended theory of planned behavior, empirical analysis shows that behavioral attitudes, subjective norms, and perceived behavioral control all positively predict the public's willingness to participate in food safety risk governance [7]. Among them, perceived risk plays a mediating role by influencing behavioral attitudes—when the public recognizes the presence of potential risks, they tend to strengthen the psychological expectation that "action is necessary," thereby increasing their willingness to engage in rights-protection and supervision. Policy regulation levels further moderate the relationship between attitude and behavioral intention: if the government can reduce public action costs through institutionalized participation channels and information disclosure mechanisms, participation rates in co-governance can be significantly enhanced.

4.2 Risk Avoidance and the Paradox of Market Consumption

Amid frequent food safety trust crises, some consumers adopt "risk avoidance" as a form of psychological compensation by deliberately distancing themselves from industrialized supply chains and turning instead to perceived safer "short-chain consumption" models—such as farmers' markets, organic food, and handmade products [19]. This logic of consumption, centered on "safety through freshness," appears rational on the surface but is often manipulated by marketing narratives and emotional identification. In seeking a sense of safety, consumers are guided by labels like "natural," "additive-free," and "non-industrial," thus falling into a "safety illusion" constructed by capital.

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This phenomenon reveals the complex tension between risk perception and behavioral response. On the one hand, risk avoidance is a natural psychological reaction to uncertain information. On the other hand, excessive avoidance behaviors may result in narrow consumption choices, further erosion of social trust, and even the emergence of new risk cycles. It follows that, without institutional guidance and scientific risk communication, risk perception can easily evolve into "behavioral overreaction" with broad social implications.

4.3 Consumer Trust and the Mediating Role of Blockchain Traceability Systems

In the reconstruction of trust pathways in food safety governance, technological intervention is regarded as a crucial mediating variable. Blockchain technology—through its decentralization, immutability, and full-process traceability—offers consumers a transparent and credible mechanism for information verification. Research based on the trust transfer theory shows that both system quality and information quality significantly enhance consumer trust in food safety [12]. In this process, system trust and supplier trust serve as key mediators, while the degree of consumer literacy about blockchain positively moderates the trust transfer effect.

At the behavioral level, when consumers can access verifiable information, their sense of uncertainty and anxiety is significantly reduced, and their purchasing and usage behaviors become more rational. This finding suggests that technological governance not only alleviates information asymmetry but also indirectly repairs the gap between public risk perception and behavioral response by strengthening systemic trust.

4.4 Online Food Safety and Public Behavior Patterns

The emergence of online food safety issues has further complicated the interaction between risk perception and behavioral response. The proliferation of online food delivery platforms, social media marketing, and live-streaming e-commerce has placed consumers in an environment of highly fragmented information, forming a cyclical pattern of "passive reception — active dissemination — emotional amplification." Research indicates that governance of online food safety requires multidimensional transformation in philosophy, institutions, and stakeholder engagement. Philosophically, a "prevention-first, full-process regulation" approach should be adopted; institutionally, an interactive co-governance model must be established; and at the stakeholder level, online service providers should be assigned clear regulatory responsibilities, thereby forming a tripartite mechanism involving government, platforms, and consumers [20].

At the same time, public opinion on the internet—being a key channel for risk information dissemination—has a significant moderating effect on public behavior. Public opinion monitoring systems based on big data and natural language processing technologies can enable "early detection, early warning, and early intervention" [14], thereby smoothing the public's cognitive curve before emotional outbreaks, reducing blind dissemination and irrational reactions. This technical approach offers new governance pathways for both government and enterprises, and serves as a "digital firewall" for public risk communication.

4.5 Comprehensive Analysis

Overall, public risk perception influences behavioral response through three primary pathways:

1. Cognitive pathway – The clearer the risk cognition and the more complete the information, the more likely the public is to adopt rational rights-protection and participatory actions.
2. Emotional pathway – Risk anxiety and distrust drive individuals to make avoidance-based choices, such as selecting foods they perceive as "safer."
3. Institutional pathway – Policy guidance, technological intervention, and social co-governance mechanisms collectively convert emotional perception into constructive behavior.

Therefore, under information asymmetry, public behavior is not merely an emotional outburst but a hybrid response combining rationality and sentiment, shaped by institutional trust, social norms, and individual experiences. If governments and enterprises can provide more transparent risk information, more reliable technological safeguards, and more inclusive participation mechanisms, they will help establish a positive feedback loop between risk perception and behavioral response.

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V. MULTIDIMENSIONAL GOVERNANCE AND OPTIMIZATION PATHWAYS UNDER INFORMATION ASYMMETRY

5.1 Government and Market: Institutional Optimization and Policy Tool Innovation

The primary task of food safety governance lies in systemic institutional optimization and the rational configuration of policy tools. Research shows that China has developed a "Chinese-style governance system" for food safety risk management, centered on government leadership and supported by market and societal collaboration. Its evolutionary path reflects a structural transformation from administrative control to risk-based governance [1][2]. However, persistent challenges remain in the domains of risk communication and information disclosure, such as “hierarchical management, decentralized information, and delayed communication” [5].

Drawing on the European Union’s experience [6], institutional design can be improved in three ways:

1. Establish cross-departmental coordination and unified information platforms to enable standardized data interoperability among departments such as agriculture, market regulation, and public health;
2. Establish independent risk assessment and communication bodies to reduce administrative interference in information disclosure and enhance scientific decision-making and transparency;
3. Improve public participation systems by legally safeguarding the public's rights to information access and expression, thereby strengthening mechanisms for societal oversight.

At the level of policy tools, institutional innovation should strike a balance between incentives and constraints. For example, whistleblower systems and reward-based reporting mechanisms are effective strategies for mitigating information asymmetry by incorporating specialized knowledge into the governance chain and enhancing early-warning sensitivity at the source [16][17]. However, such systems must be designed to balance incentive strength with behavioral restraints, avoiding risks such as abuse of reporting and information distortion. The principles of rational balance and good-faith presumption should be followed [16].

5.2 Corporate Responsibility and Optimization of Information Disclosure Mechanisms

As the primary producers and disseminators of food safety information, enterprises play an irreplaceable role in narrowing information asymmetry. Research shows that executive characteristics significantly impact the quality of information disclosure: executives with academic capital and overseas experience are more inclined to voluntarily disclose food safety information, thereby creating positive reputation constraints [10][11]. These micro-level disclosure behaviors are essential channels for transmitting risk signals.

To enhance corporate information governance capacity, the following measures are recommended:

1. Improve disclosure regulations by standardizing format, frequency, and content through mandatory disclosure requirements, thereby enhancing comparability;
2. Establish credit and reputation constraint mechanisms by imposing differentiated penalties for false or withheld information;
3. Strengthen the role of industry self-regulatory organizations by encouraging inter-enterprise information sharing and third-party certification to improve overall transparency.

Additionally, the logic of disclosure should shift from “post-incident response” to “process supervision,” forming a three-dimensional interaction framework among corporate self-inspection, government sampling, and public oversight. Enhancing corporate disclosure quality not only helps rebuild consumer trust but also reduces regulatory costs and promotes risk prevention ahead of time.

5.3 Building a Digital and Multi-Source Data-Integrated Early Warning System

Under conditions of information asymmetry, digital governance is considered a core approach for enhancing regulatory precision and risk responsiveness. Research shows that early warning mechanisms based on multi-source data fusion can efficiently detect and disseminate risk information, thereby constructing a “early-warning, rapid-response, closed-loop resolution” system [13].

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Using multilayer perceptrons and word embedding models, potential risks associated with food businesses can be automatically identified, enabling a transition from point-based anomalies to associative early warnings. This provides technological support for big data-driven food safety governance.

In terms of data standardization, efforts should be made to unify data interfaces and coding systems across departments [15], thus facilitating interdepartmental and cross-sector risk information sharing and interoperability. This system not only improves regulatory coordination efficiency but also promotes public understanding and engagement through information visualization.

Furthermore, opinion analysis systems based on Natural Language Processing (NLPIR) can monitor emotional fluctuations in online discourse in real time and detect potential risk signals [14]. By combining sentiment analysis and early-warning models, such systems can intervene before emotional polarization occurs in public opinion, reducing panic and misinformation, and offering technical support for risk communication.

5.4 Whistleblower Systems and Pathways to Enhancing Public Participation

In a framework of social co-governance, public participation and internal oversight are key to achieving transparency in risk information. Traditional reporting reward systems, though incentivizing in theory, are limited by factors such as single-mode rewards, inadequate protection, and lack of feedback mechanisms, resulting in limited effectiveness [17].

By contrast, whistleblower systems, through internal reporting and legal protection mechanisms, shift the governance focus upstream [16]. These systems provide professional and timely risk information and enhance credibility and fairness under a structured supervision framework.

Another critical pathway to enhancing public participation lies in building risk communication and education mechanisms. Strengthening food safety science education and constructing a communication trust framework can improve consumers' rational judgment in identifying and responding to risk information [7][9]. Simultaneously, the positive role of virtual communities, neighborhood organizations, and social media in risk dissemination should be promoted to guide the public from being “emotional spreaders” to becoming “rational supervisors” [4][18].

5.5 Integrated Insights

From a systems perspective, multidimensional governance under conditions of food safety information asymmetry should form the following framework:

1. Government-led institutional safeguards and coordination, ensuring risk information transparency and accountability;
2. Enterprise-driven disclosure and technological self-regulation, enabling efficient circulation of market-based information signals;
3. Public participation and societal oversight in co-governance, constructing a trust-based risk communication network;
4. Digitally supported intelligent regulatory systems, grounded in data integration, algorithmic early warning, and ethical technologies.

The synergistic resonance of these pathways signals a transformation in China’s food safety governance: from “single-center regulation” to “multi-dimensional co-governance,” from “passive response” to “proactive sensing,” and from “information closure” to “transparent sharing.” This structure forms the core feature of the modernization of China’s food safety governance system

VI. CONCLUSIONS AND IMPLICATIONS

6.1 Research Conclusions

This study centers on the core theme of “the impact mechanism of food safety information asymmetry on public risk perception and behavioral response.” It systematically integrates 21 relevant domestic and international studies and constructs a comprehensive analytical framework of “information asymmetry — risk perception — behavioral response — governance optimization.” From both theoretical and empirical perspectives, the study reaches the following main conclusions:

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(1) Information asymmetry is the root cause of the food safety trust crisis.
China's food safety governance system exhibits clear disjunctions in the processes of information acquisition, transmission, and interpretation. These asymmetries manifest across multiple dimensions, including fragmented internal government information, selective corporate disclosure, and unbalanced public access channels. These structural barriers lead to delays, dilution, and distortion of risk information during transmission, contributing to public cognitive bias and cumulative trust deficits. By contrast, the European Union's multi-stakeholder risk communication system ensures effective information flow through independent oversight and open mechanisms, offering a referential model for China's institutional improvement.

(2) Risk perception serves as a mediating variable between information asymmetry and behavioral response.
The public's risk judgment regarding food safety is shaped not only by objective incidents but also by the perceived credibility of information, emotional tones in the media, and the broader social trust structure. Risk perception influences public behavior through psychological pathways such as emotional regulation, trust transfer, and cognitive bias. In the absence of effective information verification mechanisms, people often substitute emotion for reason, expressing distrust through behaviors such as "risk avoidance" and "collective anxiety." This demonstrates that risk perception is not merely a psychological construct but also a feedback mechanism of the broader social system.

(3) Public behavioral responses are stratified and diversified.
In the co-governance structure of food safety, significant differences exist among social groups in terms of participation willingness, action pathways, and rights-protection strategies. Urban residents, individuals with higher educational attainment, and males tend to be more proactive in food safety governance. In contrast, rural residents and information-disadvantaged groups are more susceptible to emotional influence, exhibiting patterns of information amplification and behavioral imbalance. Moreover, blockchain-based traceability systems and digital public opinion monitoring mechanisms have proven effective in reducing public uncertainty, replacing traditional information trust with technological trust, and promoting rational participation.

(4) Governance optimization requires integration of institutional, technological, and social dimensions.
Modernizing food safety governance is a multidimensional coupling process. Institutionally, it calls for cross-departmental coordination and information openness; corporately, it demands strengthened information disclosure standards and reputation constraints; technologically, it relies on multi-source data integration and AI-powered public opinion monitoring to enable precise early warnings; socially, it requires a robust whistleblower protection system and enhanced public education to transform risk communication into trust co-construction. These four dimensions together form a systemic governance structure aimed at breaking information asymmetry and restoring public trust.

6.2 Policy and Practical Implications
(1) Build an open and transparent food safety information ecosystem.
A multi-tiered information collaboration system involving government, enterprises, and society should be established under the guiding principle of "data connectivity — information openness — social oversight." Food safety risk data should be standardized and dynamically shared, enabling a shift from "departmental governance" to "systemic governance." The government should strengthen legal mandates for information disclosure and traceability systems to guarantee the public's right to know.

(2) Cultivate risk communication mechanisms based on trust transfer.
In a multi-stakeholder governance environment, trust in food safety should evolve from "authority-based" to "interaction-based." Governments and enterprises can use blockchain, IoT, and other technologies to create verifiable information disclosure channels. Additionally, risk education and public opinion guidance via social media should be enhanced to prevent emotional contagion in online discourse.

(3) Improve public participation and oversight incentive mechanisms.
The public's rights and channels to participate in food safety governance should be clearly defined in laws and policies. Incentive mechanisms should be established to increase reporting efficiency and information utilization. Simultaneously, whistleblower protection policies [16] should be improved to reinforce their role in early risk identification and public warning.

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(4) Strengthen digital and intelligent governance capabilities.
Risk early-warning systems based on multi-source data integration can enable real-time, multi-dimensional regulation. By combining natural language processing and big data analysis, dynamic public opinion sensing models can be built to detect and intervene in potential risk information at an early stage. Digital governance not only enhances regulatory accuracy but also improves information transparency and regenerates public trust.

6.3 Research Limitations and Future Outlook
This study mainly adopts a qualitative analysis approach, aiming to uncover the mechanisms by which food safety information asymmetry affects public risk perception and behavioral response. However, it has the following two limitations:

First, the lack of systematic quantitative model verification limits the ability to precisely measure the relative effects among the various mechanisms. Second, the heterogeneous behavioral patterns among different groups (e.g., rural residents, young populations) require further in-depth comparative analysis.

Future research could incorporate structural equation modeling (SEM) and social network analysis (SNA) to dynamically simulate and empirically test the processes of information dissemination, trust building, and behavioral decision-making. Such approaches would offer greater predictive and explanatory power for advancing social co-governance in food safety.

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