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What makes e-participation in urban governance effective? Evidence from the Government Online Message Board in China, 2011-2021

Abstract

Globally, the importance of public participation in urban development is increasingly being emphasised, with technological advancement driving a transition from offline engagement to electronic participation (e-participation). However, achieving effective e-participation, particularly within specific governance contexts, remains a critical policy and practical challenge. Existing research into the factors influencing e-participation effectiveness often lacks a comprehensive analytical framework. Building on persuasion theory, the present research develops a framework integrating information, context and actor factors to test participation effectiveness, conceptualised through the lens of government responsiveness and encompassing both the presence and quality of the response. Leveraging a dataset of approximately 1,200,000 public opinions and governmental responses sourced from China's Government Online Message Board (2011–2021), the research investigates the status quo in public e-participation in urban governance across different provincial-level administrative divisions in China, as well as the key factors that impact effective e-participation. The results show that information (time, length, type, and topic), context (built, economic, institutional, and media environment), and actor (administrative level and geographic location) are key factors that contribute to whether and when governments respond. The research provides both a comprehensive assessment tool for e-participation effectiveness and actionable policy insights for optimising e-participation platforms, enhancing governmental accountability and promoting responsive urban governance.

Keywords: public e-participation, urban governance, persuasion theory, government responsiveness

1 Introduction

There is growing global awareness of the significance of public participation in urban planning and

governance. This can be traced to Principle 10 of the 1992 Rio Declaration, relating to citizen engagement, which was later expanded through the 1998 Aarhus Convention (Lange & Hehl-Lange, 2011). However, traditional research methodologies in this area, which predominantly focus on offline approaches such as referenda, public hearings, surveys, and advisory committees (Al-Kodmany, 2000; Frewer & Rowe, 2000), have faced challenges including inclusivity issues, financial constraints and rigid procedures. These limitations have driven innovation towards electronic participation (e-participation), defined as the use of information and communication technologies (ICTs) to broaden and deepen inclusive decision-making (Tai et al., 2020). Driven by contemporary governmental digital initiatives, including e.g. the EU 2030 Digital Compass strategy, the Digital India programme and the Digital China strategy, this shift towards digital public engagement is accelerating globally.

Despite cities worldwide deploying diverse digital tools for e-participation, such as interactive websites (Conroy & Evans-Cowley, 2006; Zhang et al., 2019), geospatial systems (Kahila-Tani et al., 2016), planning support technologies (Te Brömmelstroet, 2013), mobile applications (Ahmadi Oloonabadi & Baran, 2023; Ertiö, 2015), or social networking sites (Bonsón et al., 2019; Shaker, 2025), a persistent governance-performance gap still plagues municipal e-participation platforms globally. Studies have shown that these systems exhibit policy failures including tokenistic consultation and digitally exacerbated inequities (Sæbø et al., 2011; Sharma et al., 2022; United Nations Department of Economic and Social Affairs, 2020). Meanwhile, the necessity of building trust and willingness to participate among the public demands deeper analysis of technical and contextual factors in order to ensure privacy and security (Bouregh et al., 2023).

These challenges raise an important yet underexplored question about e-participation effectiveness: does digital engagement enable genuine inclusion or merely create the appearance of participation (Rodríguez-Bolívar et al., 2018)? Despite growing policy and scholarly attention, empirical evidence on the outcomes, impacts and effectiveness of such initiatives remains limited (United Nations Department of Economic and Social Affairs, 2020). Existing scholarship evaluates effectiveness from multiple perspectives: some scholars prioritise procedural dimensions such as

institutional fairness, transparency and process inclusivity (Bobbio, 2019; Pflughoeft & Schneider, 2020), while others emphasise measurable outcomes including policy implementation rates, participation rates, rates of "problems solved" and satisfaction metrics (Brown & Chin, 2013; Hu et al., 2020; Karkin & Cezar, 2024; Roberts & Kim, 2011). Both evaluative paradigms require contextualisation through analysis of the fundamental enablers and constraints that shape participation effectiveness.

In response to this need, existing studies have primarily evaluated participation effectiveness using a three-tiered analytical lens. At the macro level, studies often examine contextual factors, such as governance culture, regulations and broader institutional environments (Åström et al., 2012; Stratu-Strelet et al., 2021; Su & Meng, 2016). The meso level reveals how organisational culture, networks and programmes promote participation (Linders, 2012; Stratu-Strelet et al., 2021). The micro level focuses on individual characteristics, including age, education, race, gender, income, digital proficiency, and motivation (Alarabiat et al., 2021; Ju et al., 2019), as well as the properties of visualisation media, such as interactivity, immersion, realism, and dimensionality (Haynes et al., 2018; Lange & Hehl-Lange, 2005; X. Lu et al., 2021).

Although a range of factors influencing e-participation effectiveness are thus recognised, studies adopting this analytical lens primarily examine isolated elements rather than exploring their combined impacts, thereby hindering a comprehensive understanding of systemic effectiveness (Benlahcene et al., 2024; Medaglia, 2012). This fragmentation stems from three constraints (Benlahcene et al., 2024; Eilola et al., 2023; Nasr-Azadani et al., 2022; Roque de Oliveira & Partidário, 2020; Shin et al., 2024). Firstly, limited spatiotemporal scope confines most research to small-scale cases like municipal platforms or workshop environments, preventing cross-regional comparisons and obscuring scalability across governance tiers (Eilola et al., 2023; Nasr-Azadani et al., 2022). Secondly, data fragmentation manifests as misaligned micro-level behavioural logs and macro-level indicators, a problem exacerbated by restricted access to governmental workflow data (Janssen, 2011; Meijer & Potjer, 2018). Thirdly, selection bias on e-participation platforms systematically excludes digitally marginalised populations, skewing participation representation

(Ausat, 2023; Slave et al., 2023). Together, these constraints impede systemic analysis. There is therefore a need for a framework that captures interactive effects across contextual, institutional and actor-level factors.

Towards addressing this gap, China's Government Online Message Board provides a unique context for studying e-participation effectiveness through its integrated multi-tier architecture. While the platform operates within China's party-state hierarchy, its design addresses three challenges of global relevance. Firstly, the scaling deficit is mitigated by the 1.2 million urban development opinions posted on the platform from users in 31 provincial-level regions from 2011 to 2021. This facilitates a comparative analysis of regional response patterns – dynamics that are especially relevant in federated systems or Global South contexts where regional inequality affects governance. Secondly, the platform's documentation of multi-tiered government response processes illuminates how institutional hierarchies mediate participation and accountability, thereby resolving data fragmentation through systematic revelation of factor interactions. Thirdly, unlike with social media that reinforce homogeneous networks, the platform's standardised low-tech protocols empower marginalised groups (e.g., rural migrants, informal workers) to engage (Message board for leaders, 2020). This design exemplifies models of accessible participation models that may be applicable to ageing or low-literacy populations globally.

Based on the theory of government responsiveness and taking into account the realities of Chinese top-down governance, this study conceptualises "effective e-participation" as a dual process (discussed in Section 2.1): (1) the presence of responsiveness, that is, whether or not the government responds to opinions posted, and (2) the quality of responsiveness, that is, the timeliness of government replies (Su & Meng, 2016). Building on persuasion theory (Apsler & Sears, 1968; Hovland et al., 1953), we propose a refined framework that integrates informational, contextual and actor-level factors shaping participatory effectiveness in urban governance. Through an analysis of public opinions and governmental responses related to urban governance on the Government Online Message Board, the study seeks to investigate three primary research questions:

RQ1: What are the characteristics of e-participation in urban governance across various provincial-

level administrative divisions in China?

RQ2: Does the effectiveness of e-participation in urban governance vary across provincial-level administrative divisions in China?

RQ3: What factors contribute to effective e-participation in Chinese urban governance?

Thus, our study aims to advance theoretical and practical understanding of e-participation in urban governance through two principal contributions: (1) generating empirical evidence from large-scale e-participation datasets in urban governance, (2) developing an integrated analytical framework that identifies critical success factors for participatory effectiveness in urban governance.

2 Literature review

2.1 Definition of effective public participation in urban governance

The conceptualisation of effective public participation in urban governance has evolved through multiple theoretical lenses. Arnstein (1969) established a normative foundation through her Ladder of Citizen Participation model, which categorises engagement into eight levels, moving from non-participatory practices (e.g., manipulation) to citizen empowerment (e.g., delegated power), and arguing that true participation requires redistributing power to marginalised groups. This power-centric view was later complemented by communicative planning theory, which emphasises deliberative dialogue and social learning as pathways to equitable outcomes (Healey, 2003). However, a limitation of the communicative planning theory was practical feasibility, being heavily reliant on analogue methods ill-suited for scaling or real-time interaction (Potts, 2020). While digital tools overcome many of these barriers, a key emerging debate concerns the question of whether digital platforms genuinely enable transformative deliberation or merely facilitate efficient consultation within existing power structures.

Contemporary scholars have operationalised the effectiveness of public participation in two primary dimensions. On the one hand, process-oriented criteria have emphasised the quality of participatory mechanisms, for example in terms of transparency, inclusivity or deliberative quality (Bobbio, 2019; Habermas, 1979; Pflughoeft & Schneider, 2020); on the other, outcome-based measures focus on

tangible impacts, such as policy influence, social value and stakeholder satisfaction (Brown & Chin, 2013; Hu et al., 2020; Karkin & Cezar, 2024; Kreusslein & Günther, 2024; Roberts & Kim, 2011). However, this dichotomy raises unresolved tensions. Can procedurally "good" participation be deemed effective without tangible outcomes? Conversely, do valued outcomes legitimise potentially exclusionary processes? These tensions are amplified in contexts where government responsiveness and stability are prioritised over pluralist contestation.

To bridge the process–outcome division, this study adopts government responsiveness as an evaluation approach, driven by two contextual and methodological imperatives. Institutionally, the Government Online Message Board functions as a vertically integrated system designed to address governance challenges. Within this system, process-oriented quality (e.g., transparency) is embedded as a baseline requirement (Message board for leaders, 2020). Methodologically, public-end evaluations face data limitations stemming from low incentives (Xu et al., 2018) and privacy concerns (Diamantopoulou et al., 2020). In contrast, responsiveness represents the most immediate institutional reaction to citizen inputs. It precedes distal outcomes – such as policy change or satisfaction – which involve temporal lags, multiple causal factors and attribution challenges (Chen et al., 2023; Esaiasson & Wlezien, 2016). Responsiveness thus provides a directly traceable link between citizen inputs and institutional reactions, serving as a critical mediator between participatory processes and societal outcomes.

Selective responsiveness is observed across political systems but operates through distinct mechanisms. This is evident in authorities' tendency to prioritise certain public opinions while systematically disregarding others (Chen et al., 2016; Distelhorst & Hou, 2014; Su & Meng, 2016). In China, authorities prioritise specific public demands based on considerations of political stability and institutional constraints (Chen et al., 2016). In Western democracies, by contrast, response biases lean towards affluent groups or salient issues, driven by electoral incentives rather than party discipline (Wang et al., 2022). This cross-contextual parallel underscores responsiveness as a universal governance mechanism, while its filtering criteria are shaped by distinct institutional logics.

We define participation effectiveness through the dimensions of presence and quality of government responsiveness (Su & Meng, 2016), First, *presence of responsiveness* was measured as a binary variable, namely whether or not public opinions receive a reply. Second, *quality of responsiveness* was evaluated in terms of response speed – the time elapsed between submission of opinion and government reply (Su & Meng, 2016). This operationalisation rests on two rationales: (1) unacknowledged demands rarely trigger substantive actions, and (2) even symbolic responses provide citizens with procedural transparency and psychological validation, though material resolutions may require follow-up mechanisms (Su & Meng, 2016). Such differential responsiveness thus offers a comparative diagnostic lens for analysing state–citizen engagement across governance models.

2.2 From participation willingness to participation outcomes: Influencing factors of effective e-participation in urban governance

The literature on e-participation has traditionally focused disproportionately on understanding the factors that motivate public engagement, placing emphasis on initial tendencies rather than the outcomes of participation. Most studies concentrate on key drivers, for example: institutional factors including transparency, trust in local governance, ICT access, and public awareness (Choi & Song, 2020); technological factors like acceptance levels, privacy concerns and information credibility (Alam et al., 2022; Zheng & Schachter, 2017); and individual traits including prior experiences, perceived advantages and socioeconomic status (Li et al., 2024). This prevailing "input bias" prioritises explanations for participation behaviour itself rather than examining its tangible impacts or the conditions for meaningful change.

Recent studies have begun to address this gap by examining how the substantive content of public participation – including textual features and sentiment orientation – affects government responsiveness (Bouregh et al., 2023; Choi & Song, 2020; Su & Meng, 2016). For instance, using term frequency–inverse document frequency (TF–IDF), Wang et al. (2019) investigated the evolution of online public opinions and their social impact in mega construction projects. Furthermore, Shen et al. (2024) examined how different themes of public opinions regarding

community renewal were connected to different government responses. However, as Grimmer & and Stewart (2013) note, such lexical features may not fully capture the broader governance dynamics – such as power structures or institutional contexts – that also shape responsiveness, potentially limiting the explanatory scope of such approaches.

Scholars are increasingly recognising the multi-level nature of e-participation effectiveness, marking a significant advancement in understanding how factors at macro, meso and micro levels all play crucial roles (United Nations Department of Economic and Social Affairs, 2020). Macro-structural conditions such as historical traditions of civic engagement, digital infrastructure disparities and economic resource distribution create the foundational context for participation (Åström et al., 2012; Stratu-Strelet et al., 2021; Su & Meng, 2016). Meso-level factors such as state–society relationships and transnational governance influences further shape how participatory inputs are incorporated into policy processes (Cezar, 2024; Wells et al., 2020). At the micro level, individual actors' motivations, capabilities or roles, for example, can also have a significant influence (Blicharska et al., 2011; Reed et al., 2018).

Despite this progress, significant theoretical and empirical challenges remain. Current research tends to examine different analytical levels in isolation, failing to capture the interaction of macro-, meso- and micro-level contextual dimensions, treating them instead as discrete analytical units. Similarly, key components of the drivers behind participatory effectiveness, including participant attributes, information quality and contextual conditions, are often studied separately rather than as interconnected elements of a unified system (Benlahcene et al., 2024; Medaglia, 2012). This fragmentation across both levels and components obscures systemic interdependencies that need to be acknowledged for a full understanding of e-participation outcomes (Kunc, 2018; Wray-Lake et al., 2016). These limitations underscore the need for a comprehensive theoretical framework capable of integrating these diverse factors to elucidate how they collectively shape effective e-participation in urban governance.

2.3 Theoretical framework and research hypotheses

To directly address this fragmentation, moving beyond siloed, unidimensional perspectives, we propose persuasion theory as an integrated framework to enhance holistic understanding of factors affecting effective public engagement in urban governance. Persuasion here is defined as "a conscious effort at influencing the thoughts or actions of a receiver" (Bettinghaus & Cody, 1994). Both persuasion and e-participation thus share a fundamental goal: transforming public inputs into actionable governance decisions. Hovland et al. (1953)'s model persuasive communication in four stages, which mirror e-participation processes: transmission, collection, evaluation, and decision-making. The model specifies three effectiveness determinants: the communicator (source), the nature of the message (information), and the characteristics of the receiving end (audience). Apsler & and Sears (1968) expanded this model by introducing the element of "context", which refers to the environment in which the information is conveyed.

Persuasion theory is widely applied in marketing (Braca & Dondio, 2023), educational programmes (Murphy, 2001) and political propaganda (Cakanlar & White, 2023), yet its implementation in public participation remains underexplored. Existing studies mainly examine individual dimensions in isolation. For example, Chen et al. (2020) analysed linguistic strategies in petitions (information dimension), while Lee et al. (2017) quantified the effects of policy framing on participation processes (context dimension). Despite enhancing specific knowledge in the field, such approaches do not adequately address the dynamic interconnections between source credibility, message design, audience targeting, and contextual mediation. A more comprehensive approach is needed to tackle the complex challenges of persuasion in urban governance.

In the case of the Chinese Government Online Message Board specifically, the persuasion model faces challenges, particularly concerning the dynamics between sources and audiences. On the source side, the anonymity of e-participation often obscures participants' socioeconomic attributes, complicating the assessment of persuasive intent. On the audience side, while citizens nominally address specific government agencies (e.g., provincial leaders), messages are actually processed by subordinate administrative intermediaries. This practical situation calls for altering the focus of

analysis from individual characteristics towards broader institutional patterns.

Therefore, we synthesise persuasion's multidimensional features with governmental responsiveness mechanisms, as illustrated in our integrated framework (Figure 1). Specifically, we posit that information, context and actor have a confounding impact on effective e-participation. Information is broken down into length, sentiment, type, time, and topic; context refers to the built, economic, institutional, and media environments; and actor includes the administrative level and geographic location of the governance bodies. For dependent variables, as mentioned above, we operationalise effectiveness through two measurable parameters: (1) presence of responsiveness (response or not), and (2) quality of responsiveness (response time).

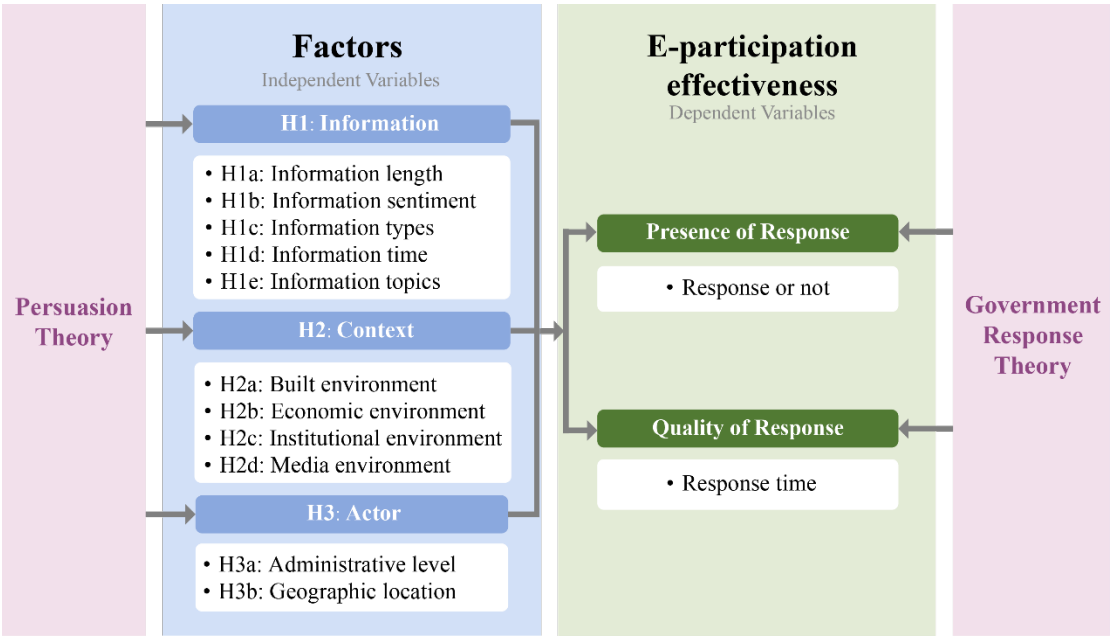


Figure 1 Conceptual framework

2.3.1 Information

The expression of public opinion on e-participatory platforms is a type of discourse expression in textual form. Text classification is the process of categorising text into organised groups according to pre-defined rules; in communication studies, this often includes sentiment analysis, news categorisation and topic classification (Minaee et al., 2021). Textual analysis has helped researchers to understand informative factors that influence the popularity of e-participation. These studies

analyse the text provided by the information sender to infer how linguistic, semantic and thematic factors are related to government response (Bagozzi et al., 2021; Li et al., 2019; Shen et al., 2024; Wang et al., 2019). Such research suggests that the semantics, types and topics of public opinions may influence government responsiveness in Chinese urban governance.

Psychological and communication studies have shown that excessively long texts can lead to information overload, reducing readers' ability to understand and remember, potentially affecting decision-making (Arnold et al., 2023). Therefore, information length may also impact e-participation results. In addition, policy innovation and comprehensive reform have been shown to result in significant progress (Arun Kumar et al., 2024), raising the possibility that government responses may vary over time. It is therefore posited that the following information factors influence effective e-participation:

Hypothesis 1: Public information influences effective e-participation in urban governance.

H1a: Information time significantly influences effective e-participation in urban governance.

H1b: Information length significantly influences effective e-participation in urban governance.

H1c: Information sentiment significantly influences effective e-participation in urban governance.

H1d: Information types significantly influence effective e-participation in urban governance.

H1e: Information topics significantly influence effective e-participation in urban governance.

2.3.2 Context

Contextual factors can influence how people interact with a city and its infrastructure. Prior research has shown how the outcomes of public participation are affected by local socioeconomic, cultural and institutional contexts (Blicharska et al., 2011; Reed et al., 2018). Specific contextual elements that can significantly impact the effectiveness of an engagement initiative include the presence of a participatory culture as well as economic development level and available resources, as public opinions may disproportionately originate from areas characterised by above-average income levels (Weersink & Raymond, 2007). Research also indicates that the institutional context, along with power dynamics – particularly in areas or institutions that already have decision-making power – can significantly influence the nature of the decisions made (Zeitoun et al., 2011).

Previous studies have demonstrated that media significantly influence individuals' willingness to engage in political discussions (Boulianne, 2015; Geise et al., 2020). Acknowledging that ICT infrastructure is a fundamental enabler of digital participation, our research design controls for technological variance through exclusive focus on a nationally standardised e-governance platform. This approach isolates media context effects by ensuring uniform technological mediation across all cases. We utilise internet penetration rates as a measure of media environments because they directly reflect citizens' access to e-participation tools while simultaneously indicating the population coverage breadth of digital governance initiatives. Previous research has established a link between the quality of the built environment and public satisifaction (Mouratidis, 2021). Thus, it is plausible that individuals' perceptions of their living conditions could contribute to shape their public opinions, in turn affecting participation effectiveness. Based on the cited literature, we formulate the following hypotheses regarding the effect of the contextual environment on effective e-participation:

Hypothesis 2: The contextual environment influences effective e-participation in urban governance.

H2a: The context of the built environment significantly influences effective e-participation in urban governance.

H2b: The context of the economic environment significantly influences effective e-participation in urban governance.

H2c: The context of the institutional environment significantly influences effective e-participation in urban governance.

H2d: The context of the media environment significantly influences effective e-participation in urban governance.

2.3.3 Actor

As discussed earlier, e-participation anonymity conceals participants' socioeconomic attributes. Our analysis does not examine individual sources but instead focuses on macro-level institutional characteristics. This shift is crucial as response actors play a vital role in achieving effective participatory outcomes. The success of engagement is profoundly shaped by power dynamics and the values of the actors in question (Jiang et al., 2019). Prior studies have shown that the public

tends to place greater trust in higher levels of government, with central oversight proving to be more effective in encouraging public engagement than lower levels of government (Zhang et al., 2021). Additionally, the resources available to government departments vary across regions, leading to differing perceptions of political efficacy among the public, which influence, in turn, the levels of public participation and participatory effectiveness (Prats & Meunier, 2021). Consequently, the following hypotheses are proposed regarding response actors:

Hypothesis 3: The response actor significantly influences effective e-participation in urban governance.

H3a: The administrative level of the response actor significantly influences effective e-participation in urban governance.

H3b: The geographic location of the response actor significantly influences effective e-participation in urban governance.

3 Methods

3.1 Research overview

This study systematically investigates the driving factors of e-participation effectiveness in urban governance. It analyses approximately 1.19 million messages from the "Urban development" section of the *People's Daily* Online Leadership Message Board (2011–2021), covering all 31 provincial-level administrative divisions in China. The research employs a multidimensional quantitative analysis with the following analytical steps. First, textual features of information dimensions are extracted using LDA topic modelling, sentiment analysis and Excel VLOOKUP. Second, a comprehensive indicator system for contextual factors – encompassing the built, economic, institutional and media environments – is constructed via the entropy weight method. Third, administrative levels and geographical variables are integrated under the actor dimension. Finally, chi-square tests are used to analyse differences between the categorical variables; one-way ANOVA tests are used to analyse differences between the continuous variables; and logistic and linear regression models are employed to verify the core driving factors for the response mechanisms (see Figure 2).

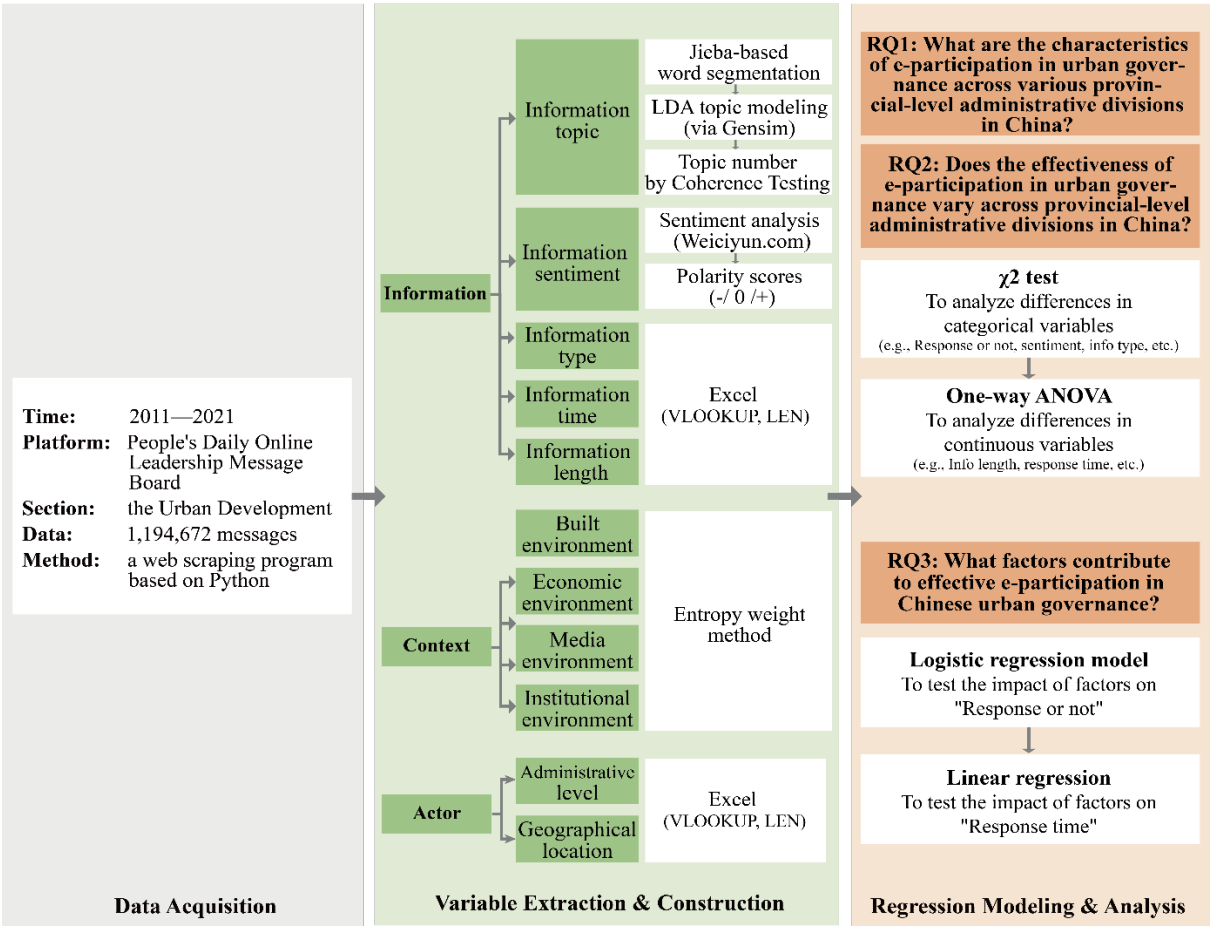


Figure 2 Research overview

3.2 Case study

The study is based on the Government Online Message Board on the *People's Daily* website (人民网领导留言板), which has been the largest and most popular nationwide government e-platform in China since it was established in 2006 (Meng & Yang, 2020). This platform is designed to facilitate interaction between the public and government leaders, permitting members of the public to address demands, complaints and recommendations to government leaders across various tiers, including at provincial, prefecture and county level. Official responses are subsequently published beneath the original platform posts once the relevant authorities have taken appropriate action (Figure 3).

Figure 3 An annotated example of China's Government Online Message Board on the *People's Daily* website

3.3 Data sources and collection

In collaboration with the CnOpenData company (https://www.cnopendata.com/), data were collected by using Python Web-scraping techniques on the "Urban development" section of the Government Online Message Board on the People's Daily website. This section contains public opinions that need actions to be taken from governmental authorities involved in urban planning and governance, such as "Natural resources", "Land and resources", and "Housing and urban–rural development". Data collection focused on the period 2011–2021, primarily to ensure structural consistency of the data: archived data were unavailable for 2006–2011, and website format changes after 2022 altered the underlying data structure, compromising overall data consistency and preventing valid parallel comparison. Furthermore, this timeframe encompasses key technological shifts (mobile internet penetration surpassed 700 million users in 2016; and the national platform enabling cross-departmental data integration was launched in 2019), thus covering traditional, transitional and integrated phases. After cleansing duplicate and missing entries, the final dataset comprised 1,194,672 messages, with 1,005,797 (84.2%) receiving responses.

The analysis covered 31 provincial-level administrative divisions in China. These included 22 provinces (Hebei, Shanxi, Liaoning, Jilin, Heilongjiang, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi,

Shandong, Henan, Hubei, Hunan, Guangdong, Hainan, Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, and Qinghai), five autonomous regions (Inner Mongolia, Guangxi Zhuang, Tibet, Ningxia Hui, and Xinjiang Uygur) and four municipalities (Beijing, Tianjin, Shanghai, and Chongqing). Notably, the special administrative regions (SARs) of Hong Kong and Macau, as well as Taiwan, were excluded, as their independent political systems might have decreased the validity and universality of the data collected.

3.4 Data analysis

3.4.1 Information dimension

The information dimension includes five aspects: time, length, sentiment, type, and topic. As shown in Figure 3, the raw data collected from the platform contained the original content provided by users, along with content type and timestamp. Utilising a highly automated quantitative approach, information processing included sampling and data collection, synchronic analysis, lexical framing, and regression analysis (Berente et al., 2018). Information type and timestamp for each case were processed using the VLOOKUP function in Excel; the LEN function was employed to calculate the number of characters in each comment, thereby obtaining data on information length.

To identify information topics, the Latent Dirichlet Allocation (LDA) model was used (Grimmer & Stewart, 2013). This model analyses the distribution of topics in documents using a "bag-of-words" approach, illuminating topic structure in a probabilistic way (Chen & Duan, 2022; Shen et al., 2024). Before running the LDA analysis, a suitable number of topics was determined through coherence testing. The model then automatically generated key terms and their distribution for each topic. The Jieba library in Python was used to break down the texts and calculate word frequency for the entire dataset (Li et al., 2019). After that, LDA topic modelling was conducted using the Pysql and Gensim libraries. Finally, a detailed review of the original text was conducted alongside the LDA findings in order to examine the specific features and content of each topic in the original dataset.

Sentiment analysis (SA) is a method of processing, classifying and summarising subjective, emotion-laden information, typically involving three main steps: extraction, classification and

retrieval (Nandwani & Verma, 2021). In this study, SA was applied to evaluate sentiments based on emotional or attitudinal words in the posts and their frequencies, using a professional Chinese sentiment-processing tool (weiciyun.com). This tool automatically generates sentiment polarity scores through algorithmic processing of textual components, with particular emphasis on the identification and frequency calculation of emotional markers. The scoring system is based on a three-tier classification: messages receiving scores below zero (-∞, 0) were categorised under negative valence; those exceeding zero (0, +∞) under positive valence; and precisely neutral evaluations were assigned a zero-point designation (Liu et al., 2025).

3.4.2 Actor dimension

The response actor dimension includes two variables: administrative level and geographical location. For the analysis, a three-part classification system was employed based on Shen et al. (2024), categorising geographical location under eastern, central or western areas of China. The VLOOKUP function in Excel was used to assign each case to its corresponding region, based on the actor region in the raw data (Figure 3). In line with the administrative divisions of the People's Republic of China, cases were classified as provincial-, prefectural- or county-level.

3.4.3 Context dimension

The context dimension include data concerning built, economic, institutional and media environments. The contextual information regarding the built environment was obtained from the Qianzhan database (https://d.qianzhan.com/), a certified high-tech industrial consulting service that has made a number of advancements in big data; the company owns a variety of data technology patents. It benefits from substantial backing from national organisations in China, such as the National Bureau of Statistics and the Tsinghua University Library. The built environment data included information related to urban construction, municipal facilities, urban green spaces, and urban facilities (Table 1). Using the entropy method (Elena Arce et al., 2015), they were assessed and computed based on a set of two-tier indicators, culminating in an overall score reflecting the quality of the built environment across the various provincial-level administrative divisions.

Table 1 The weighted indicators for the context of the built environment

Variable	Primary indicator	Secondary indicator
Built environment	Urban construction conditions	Urban built-up area (year)
		Urban constructed area (year)
		Urban construction land area (year)
		Urban land requisition area (year)
		Urban population density (year)
	Municipal facilities	Actual road length in cities (year)
		Actual road area in cities (year)
		Number of urban bridges (year)
		Length of urban drainage pipelines (year)
		Number of street lighting fixtures in cities (year)
	Urban green spaces	Urban green space area (year)
		Urban green space area: park green space (year)
		Number of urban parks (year)
		Area of urban parks (year)
		Green coverage rate of built-up areas in cities (year)
	Level of urban facilities	Number of public transport vehicles per 10,000 people in cities (year)
		Per capita urban road area (year)
		Per capita Park green space area (year)
		Number of public toilets per 10,000 people in cities (year)

Drawing upon Besley and Burgess (2001) and Dong et al. (2011), the economic environment was established based on the aggregation of the per capita disposable income (PCDI), gross domestic product (GDP) and consumer price index (CPI) growth rates. Data were sourced from the EPS Data Platform's China Macro-Economic Database (https://www.epsnet.com.cn/). EPS databases are authoritative, based on the China Statistical Yearbook compiled by the National Bureau of Statistics and Ministry of Housing and Urban–Rural Development.

The institutional environment data relate to e-governance performance levels and the presence or absence of a responsiveness mechanism. The term "responsiveness mechanism" is defined as a formalised system for addressing inquiries on the Government Online Message Board, that is, one which is documented in an official government publication (source:

http://leaders.people.com.cn/GB/178291/218130/370358/index1.html). Data regarding "e-governance performance levels" were obtained from the annual evaluations of Chinese government websites conducted by the China Software Testing Centre. In each year, it was assessed whether the administrative divisions at the provincial level were ranked among the top ten.

The media environment was established through analysis of "internet penetration rate" across various years, drawing on data sourced from the Yearbook of the National Bureau of Statistics of China for each provincial-level administrative division (source: https://www.stats.gov.cn/sj/ndsj/). The rate was derived by taking the number of internet users in a specific region and dividing it by the population of long-term residents in that area.

3.4.4 Statistical analysis

For research questions 1 and 2, a descriptive analysis was employed to outline the characteristics of public e-participation and government responsiveness in Chinese urban governance. Chi-square analyses were used to determine whether significant differences existed across provincial-level administrative divisions among the categorical variables, including response or not, information sentiment, information type, and information topic. A one-way ANOVA test was used to assess significant differences concerning continuous variables, including information time, information length and average response time (Field, 2013). For research question 3, the dependent variables were response or not and response time. The independent variables were subfactors from the information, context and actor dimensions. Because "response or not" is binary, logistics regression was used to determine whether significant differences existed. Conversely, response time was measured by continuous data, "average days taken to reply". Therefore, a regression analysis was used to determine whether particular independent variables significantly predicted dependent variables (Field, 2013). The significance level was set to 0.05.

3.5 Data representation

This study uses descriptive charts and geospatial mapping to present the multidimensional and spatial characteristics of public e-participation. Stacked bar charts were created to visualise the

distribution of five core variables across 31 provincial-level regions: information sentiment, information types, information time, information length, and information topics. These enabled comparisons of public input across regions and over time. To highlight spatial disparities in government responsiveness, choropleth maps were generated using ArcGIS Pro 10.8. After aggregating provincial-level values for two indicators – response rate and response time – the data were spatially joined to a standard administrative base map of China (Plan Approval No. GS (2024) 0650). The "natural breaks" method in GIS was applied to divide values into five classes, enhancing interpretability of regional differences. This method optimises the grouping of similar values and maximises the differences between classes, thereby effectively highlighting the spatial disparities in government responsiveness across the provincial-level regions.

4 Results

4.1 RQ1: What are the characteristics of e-participation in urban governance across various provincial-level administrative divisions in China?

The chi-square analyses and ANOVA tests showed significant differences in information sentiment, types, time, length, and topics between different provincial-level administrative divisions, as shown in Tables 2 and 3.

Table 2 Results of One-Way ANOVA

Content		Sum of squares	d*f*	Mean square	F	sig.
Information time	Between groups	147196.5907	30	4906.553024	1204.691351	0.000
	Within groups	4860841.758	1193468	4.072871462		
	Eta-Squared（η^2）	0.029392065				
Information length	Between groups	434636892.1	30	14487896.4	666.6658484	0.000
	Within groups	25936249485	1193466	21731.87128		
	Eta-Squared（η^2）	0.016481694				
Average response time	Between groups	145036176	30	4834539.201	1279.17355	0.000
	Within groups	3797996078	1004914	3779.423989		
	Eta-Squared（η^2）	0.036782904				

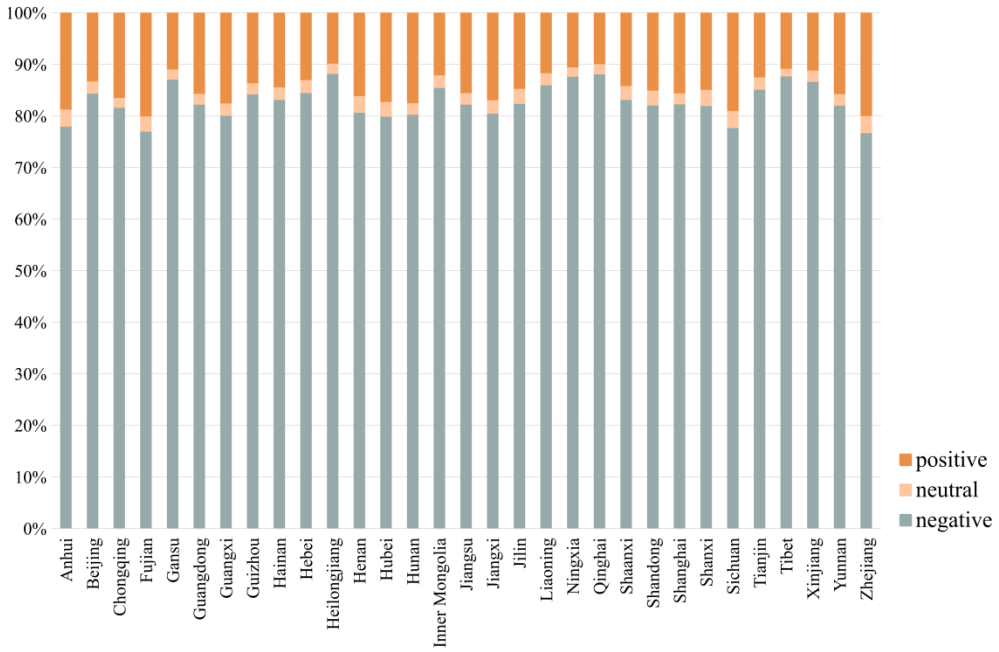
Table 3 Results of Chi-Square Test

Content		value	sig.
Information sentiment	Phi	0.08	0.000

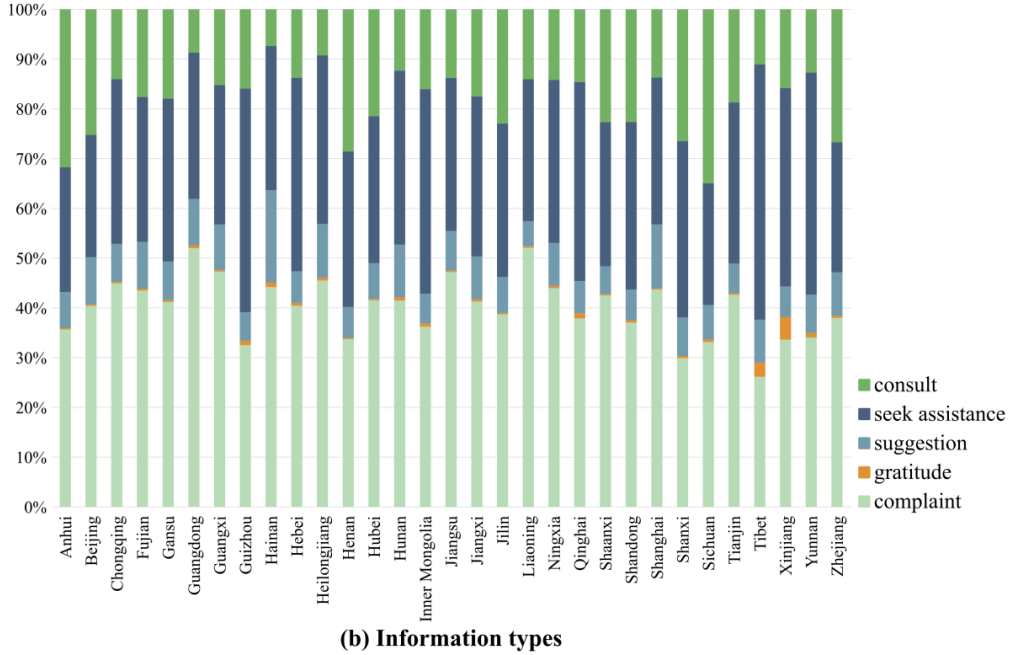
	Cramér's V	0.056	0.000
Information types	Phi	0.225	0.000
	Cramér's V	0.113	0.000
Information topics	Phi	0.395	0.000
	Cramér's V	0.096	0.000
Response or not	Phi	0.285	0.000
	Cramér's V	0.285	0.000

Figure 4a depicts the distribution of “negative”, “positive” and “neutral” sentiment within public opinions. The findings indicate that negative sentiments were overwhelmingly prevalent across all provinces and municipalities, with proportions varying from 75% to 90%. Conversely, the presence of neutral or positive sentiments was notably minimal. Figure 4b presents the proportions of five distinct types of public opinions, the majority being categorised under “complaint”, “seek assistance” and “consultation”, with a few posts under “suggestion” and “gratitude”.

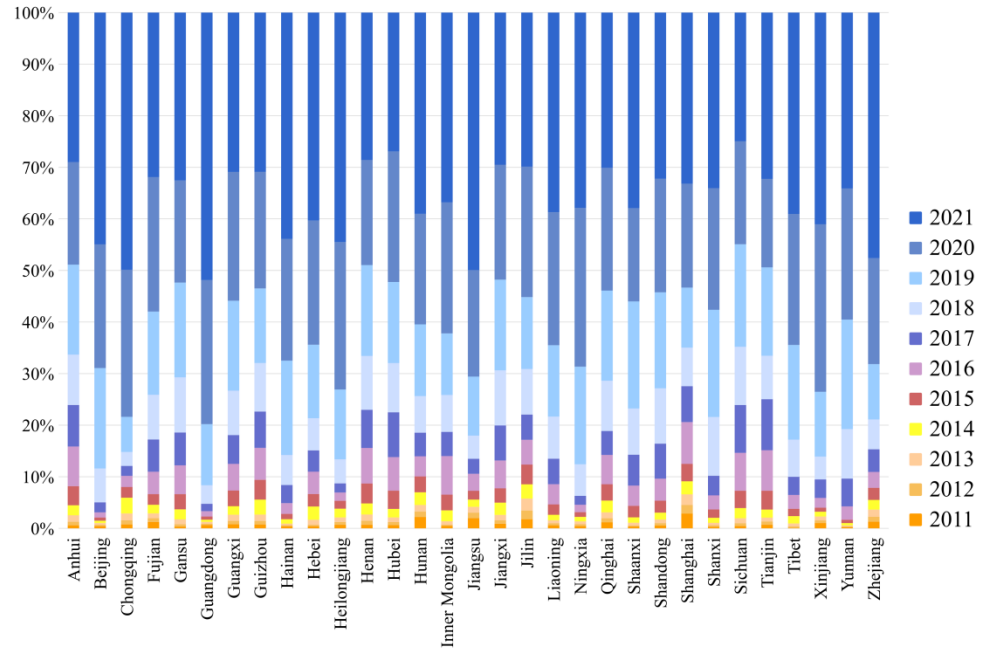
Figure 4c illustrates the annual distribution of public opinions from 2011 to 2021. In general, the volume of expressed public opinions in the studied areas demonstrated an upward trend, with a notable surge beginning in 2016. Although a minor decrease was recorded in certain regions in 2017, numbers peaked in 2020 and 2021. Information length remained largely stable across the nation, with Beijing, Heilongjiang and Shanxi exhibiting particularly consistent distributions (Figure 4d). The distribution of information types in relation to the 18 topics identified via LDA is depicted in Figure 4e. The topic “developer breaches and real estate certificate problems” consistently represented the largest share in most provincial-level administrative divisions, throughout the decade.



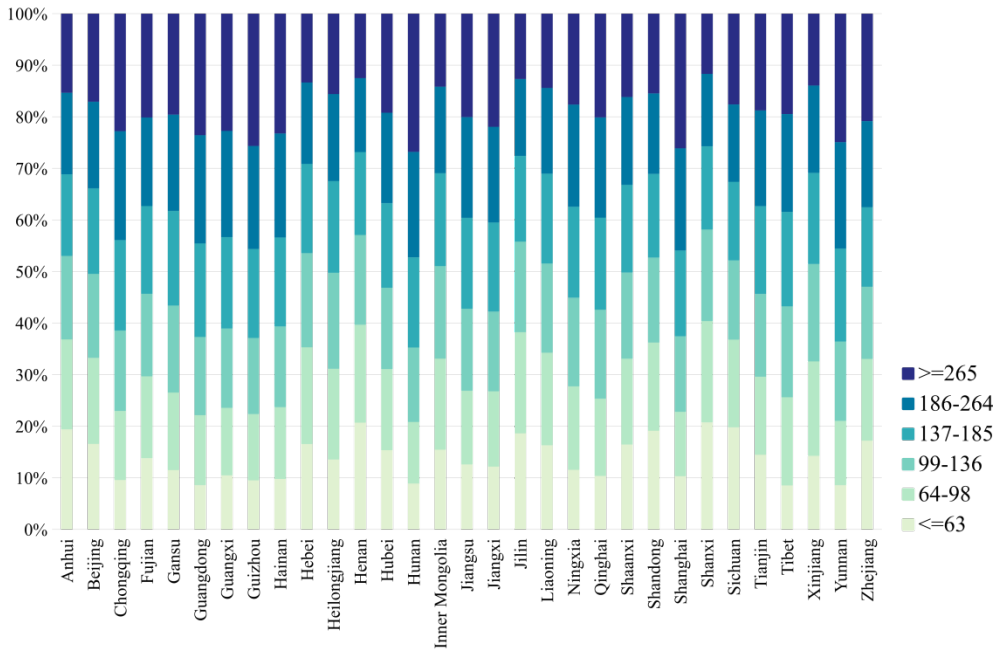
(a) Information sentiment



(b) Information types



(c) Information time



(d) Information length

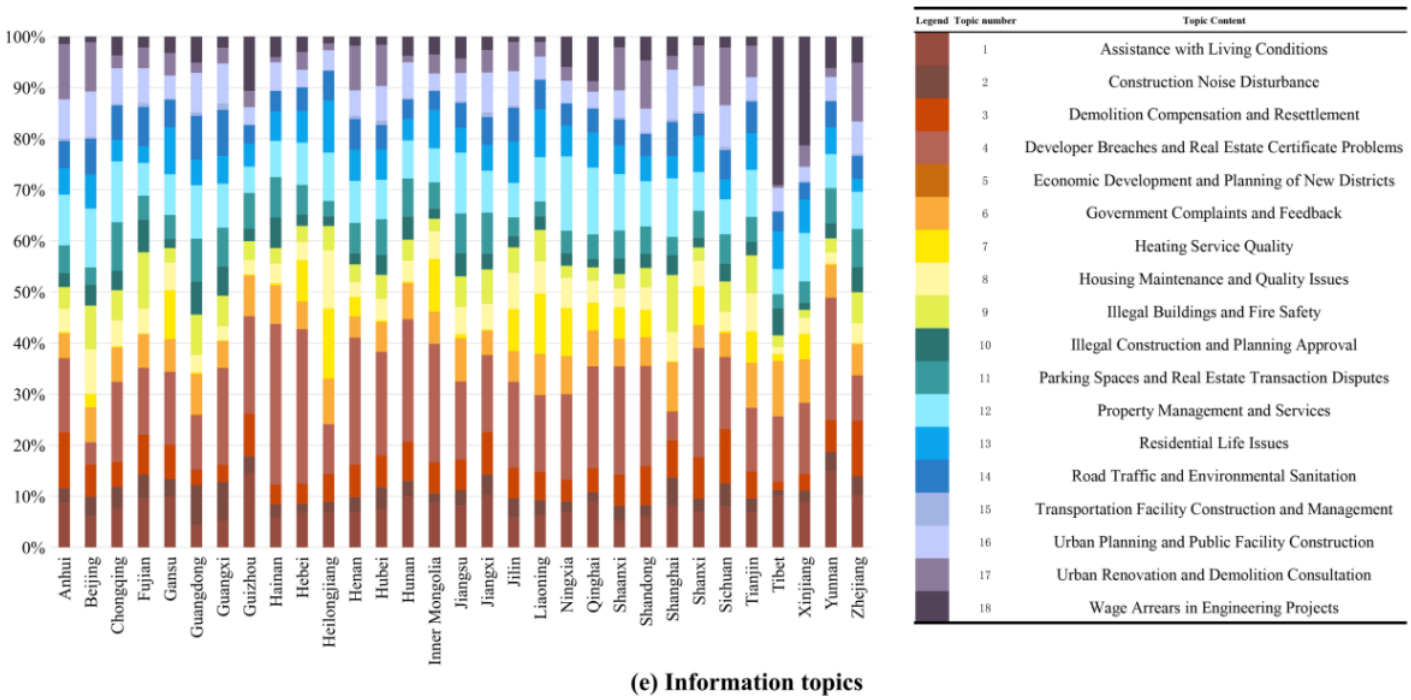


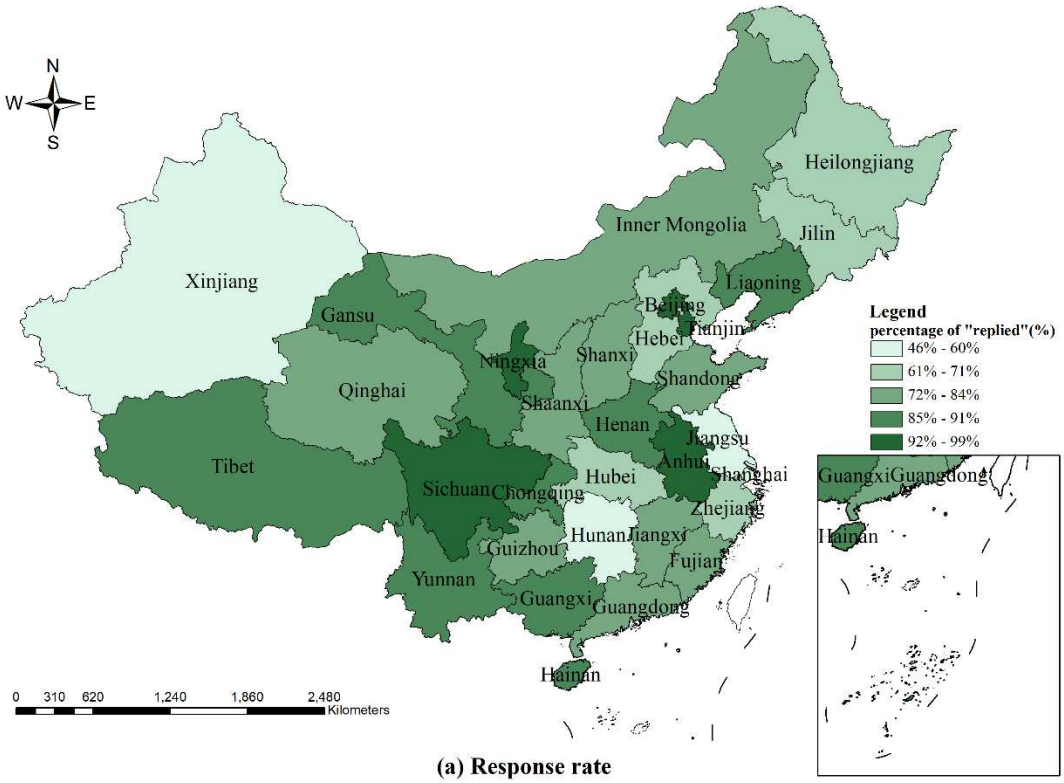
Figure 4 The information dimension of public opinions: (a) information sentiment, (b) information types, (c) information time, (d) information length, (e) information topics

4.2 RQ2: Does the effectiveness of e-participation in urban governance vary across provincial-level administrative divisions in China?

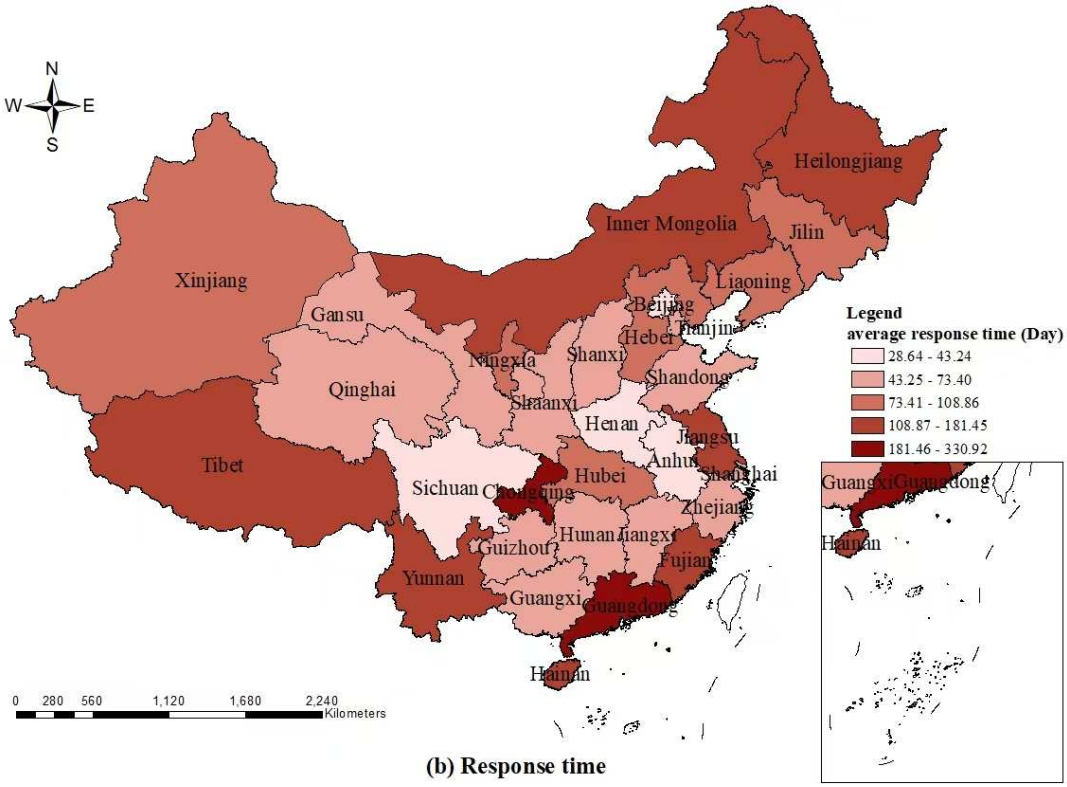
As shown in Tables 2 and 3, significant differences existed in terms of response or not and average response time between different provincial-level administrative divisions.

Figure 5a depicts the total number of public opinion posts in relation to the government's inclination to respond. Overall, the rate of government response across different provincial-level administrative divisions consistently exceeded 50%. The lighter- to darker-green-coloured areas on the map show an increasing trend in government response rates. Five province-level divisions in particular – Beijing, Tianjin, Anhui, Sichuan, and Ningxia – exhibited higher response rates, indicating a stronger inclination to address public opinions. In contrast, Jiangsu, Shanghai, Hunan, and Xinjiang show lower response rates.

Among those public opinions that received responses, the interval between the time posted and the time of response is illustrated in Figure 5b, reflecting government efficiency in handling and responding to public opinions in each case. There was a significant disparity in the average response time among different areas during the period analysed. As shown by the light-red colour, Anhui, Henan and Sichuan reported shorter response times, with effective replies typically provided within approximately one month. In contrast, Guangdong and Chongqing showed longer average response times.



(a) Response rate



(b) Response time

Figure 5 Response effectiveness: (a) response rate, (b) response time

4.3 RQ3: What factors contribute to effective e-participation in Chinese urban governance?

4.3.1 Information

Information played a role in both response or not and response time. The results showed that information time, and type and topic significantly predicted response or not and response time (Tables 4 and 5). However, information length and sentiment did not significantly predict effects. More recent public participation (i.e., in 2021 vs. 2011) generally led to a higher possibility of receiving a government response ($p < 0.001$). Regarding information type, consultation and complaint led to a higher possibility of government response compared with posts expressing gratitude. Topics concerning urban renovation, demolition consultation and road traffic environmental sanitation were more likely to receive a response, while topics concerning wage arrears in engineering projects were least likely to receive a response.

Longer information led to a later reply. In comparison with 2011, public opinions expressed in subsequent years were responded to later ($p < 0.001$). Topics such as wage arrears in engineering projects or illegal buildings and fire safety were more likely to receive a later response than other topics ($p < 0.001$). Posts regarding disputes over urban renovation and demolition consultation were more likely to elicit a prompt response in comparison with posts on other topics ($p < 0.001$). Nevertheless, the sentiment of public opinion did not serve as a significant predictor of response time.

4.3.2 Context

Contextual factors, including the built, economic and institutional environments, significantly affected whether and when the government responded (Tables 4 and 5). In particular, the public in areas with a better economic environment were more likely to receive a response ($p < 0.001$). Those in areas with a stronger institutional environment (i.e., better e-governance performance level and established response mechanism) were more likely to receive a response than those in weaker institutional environments ($p < 0.001$). People in areas with a stronger media environment (i.e., penetration of internet rate) or an improved built environment were less likely to receive a response ($p < 0.001$).

In terms of response time, individuals in areas characterised by superior institutional and economic environments received a quicker response ($p < 0.001$). Conversely, those in areas with a more advanced built environment generally received responses at a slower rate ($p < 0.001$). Additionally, However, the media environment did not have a significant effect on response time.

4.3.3 Actor

In relation to the actor dimension, the administrative level and the geographic location significantly predicted participation effectiveness ($p < 0.001$) (Tables 4 and 5). Government authorities with a lower administrative level were more likely to give an early response, and opinions in the western region of China were more likely to receive early feedback than those in the eastern region. However, only the geographic location significantly impacted response or not ($p < 0.001$); the administrative

level of the response actor did not significantly predict the results ($p < 0.001$).

Table 4 Logistics analysis showing factors affecting response or not

Variable	Category	B	S.E.	Wald	df	Sig.	Exp(B)
Information	Information type						
	complaint	Reference					
	gratitude	-0.192	0.039	24.709	1	0.000	0.825
	suggestion	-0.076	0.012	38.668	1	0.000	0.927
	seek assistance	-0.031	0.007	19.589	1	0.000	0.970
	consultation	0.356	0.010	1355.580	1	0.000	1.428
	Information topic						
	residential life issues	Reference					
	property management and service	-0.038	0.016	5.652	1	0.017	0.963
	construction noise disturbance	0.109	0.020	28.955	1	0.000	1.116
	heating service quality	-0.077	0.019	16.544	1	0.000	0.926
	government complaints and feedback	-0.105	0.017	40.229	1	0.000	0.900
	wage arrears in engineering projects	-0.442	0.019	522.538	1	0.000	0.643
	transport facility construction and management	0.069	0.048	2.051	1	0.152	1.071
	housing maintenance and quality issues	0.032	0.019	2.985	1	0.084	1.033
	parking space and real estate transaction disputes	-0.200	0.017	138.616	1	0.000	0.819
	illegal construction and planning approval	-0.114	0.020	32.355	1	0.000	0.892
	seek assistance with living conditions	-0.205	0.015	177.038	1	0.000	0.815
	developer breaches and real estate certificate problems	-0.124	0.014	83.021	1	0.000	0.883
	economic development and planning of new districts	-0.010	0.091	0.012	1	0.913	0.990
	illegal buildings and fire safety	0.089	0.018	24.500	1	0.000	1.094
	urban renovation and demolition consultation	0.284	0.019	223.464	1	0.000	1.329
	road traffic environmental sanitation	0.143	0.018	64.174	1	0.000	1.154
	urban planning and public facility construction	-0.005	0.018	0.095	1	0.758	0.995
	demolition compensation and resettlement	-0.055	0.016	11.588	1	0.001	0.946
	Information time						
	year=2011	Reference					
	year=2012	0.423	0.039	120.139	1	0.000	1.526
	year=2013	0.997	0.035	805.613	1	0.000	2.709
	year=2014	1.266	0.032	1531.034	1	0.000	3.548
	year=2015	1.254	0.031	1662.881	1	0.000	3.504
	year=2016	1.394	0.030	2222.125	1	0.000	4.033
	year=2017	1.869	0.030	3904.713	1	0.000	6.481
	year=2018	2.019	0.030	4518.531	1	0.000	7.533
	year=2019	1.813	0.030	3649.958	1	0.000	6.127
	year=2020	2.565	0.031	6892.379	1	0.000	13.002
	year=2021	3.182	0.033	9486.404	1	0.000	24.095
Context	Built environment	-1.117	0.028	1610.536	1	0.000	0.327
	Economic environment	0.569	0.032	318.416	1	0.000	1.766
	Institutional environment						

	E-government performance level=Top 10	0.372	0.007	2776.127	1	0.000	1.451
	Establishment of a response mechanism=Yes	0.827	0.009	8893.037	1	0.000	2.286
	Media environment	-0.023	0.000	2958.446	1	0.000	0.977
Actor	Administrative level						
	provincial level government	Reference					
	prefectural level government	0.842	0.007	14138.489	1	0.000	2.320
	county level government	0.956	0.008	14830.306	1	0.000	2.601
	Geographic location						
	eastern region	Reference					
	central region	0.201	0.008	713.658	1	0.000	1.222
	western region	0.611	0.009	4744.369	1	0.000	1.842

Note: based on 1,194,672 messages related to urban planning, 2011 to 2021

Table 5 Regression analysis indicating factors affecting response time

		Unstandardized Coefficients		Standardized Coefficients		
Variable	Category	B	Std. Error	Beta	t	Sig.
Information	Information length	0.006	0.001	0.013	11.237	0.000
	Information time	-3.109	0.041	-0.090	-76.556	0.000
	Information type= complaint	Reference				
	consultation	-2.065	0.212	-0.013	-9.738	0.000
	gratitude	-3.633	1.165	-0.003	-3.117	0.002
	suggestion	-0.799	0.316	-0.003	-2.527	0.011
	Information topic = residential life issues	Reference				
	wage arrears in engineering projects	6.623	0.482	0.016	13.742	0.000
	demolition compensation and resettlement	-2.124	0.312	-0.008	-6.813	0.000
	urban planning and public facility construction	-1.860	0.352	-0.006	-5.290	0.000
	heating service quality	-1.732	0.418	-0.005	-4.145	0.000
	urban renovation and demolition consultation	-8.625	0.328	-0.034	-26.262	0.000
	construction noise disturbance	-1.426	0.425	-0.004	-3.356	0.001
	housing maintenance and quality issues	1.512	0.301	0.006	5.021	0.000
	illegal buildings and fire safety	1.608	0.377	0.005	4.267	0.000
	property management and service	1.008	0.292	0.004	3.456	0.001
	parking space and real estate transaction disputes	1.158	0.349	0.004	3.318	0.001
	housing maintenance and quality issues	1.042	0.387	0.003	2.692	0.007
	transport facility construction and management	-2.639	1.109	-0.003	-2.381	0.017
Context	Built environment	18.200	0.788	0.045	23.109	0.000
	Economic environment	-35.200	0.810	-0.077	-43.467	0.000
	Institutional environment					

	E-government performance level=Top 10	-3.784	0.183	-0.027	-20.663	0.000
	Establishment of a response mechanism=Yes	-9.029	0.313	-0.033	-28.840	0.000
Actor	Administrative level = provincial level government	Reference				
	prefectural level government	-12.829	0.223	-0.090	-57.488	0.000
	county level government	-8.547	0.212	-0.062	-40.293	0.000
	Geographic location= eastern region	Reference				
	central region	-3.634	0.215	-0.026	-16.886	0.000
	western region	-9.817	0.223	-0.069	-44.041	0.000

Note: based on 1,005,797 responses to messages related to urban planning, 2011 to 2021

5 Discussion

This study reveals notable variations in the effectiveness of public e-participation within urban governance structures across various provincial-level administrative divisions in China. Furthermore, the results suggest that effectiveness is generally enhanced through the factors of information, context and actor.

5.1 Information: While the influence of sentiment is not significant, topic, type, time, and length play a role

Concerning information topics, public opinions regarding urban renewal and demolition were most likely to receive a quick response. Conversely, opinions related to wage arrears in engineering projects were the least likely to receive a response, and, when responses were received in these cases, they were often delayed. Unpaid wages are a persistent and significant challenge in China (Wei & Chan, 2022). Many workers, often those with low educational backgrounds, neglect to sign labour contracts at the commencement of engineering projects. This lack of formal documentation can complicate the ability of relevant authorities to address the problem effectively. The findings indicate that information types such as consultations and complaints were more likely to obtain effective responses than expressions of gratitude or suggestions. This phenomenon may stem from a combination of factors, including officials' anticipation of negative repercussions if complaints are ignored, as well as their motivation to shield themselves from potential penalties (Hossain et al., 2024; Wang et al., 2024). Studies in comparable contexts, such as India, reveal that grievance

systems tend to address contentious complaints ahead of positive or neutral feedback, driven by analogous incentives (Bussell, 2019).

Response time emerged as a pivotal factor. Over the 11 years included in the study, despite the burgeoning volume of public opinions being posted, the government significantly enhanced its efficiency in terms of responsiveness. This improvement could be attributed to heightened recognition and prominence of the Online Message Board for Leaders. The shift towards a more digital and efficient governance system has also facilitated quicker and more effective communication between the government and the public (Lubis et al., 2024). Similar trends have been documented in e-governance reforms worldwide, where digital platforms reduce bureaucratic delays and improve transparency (Sharma et al., 2022)**.** Text length proved to be significant: public opinions expressed more concisely tended to elicit quicker responses. This could be attributable to the complexity of longer texts, which can complicate the processing of information from the government side (Lu et al., 2023). This aligns with U.S. research on citizen-government communication, highlighting that a clear citizen voice and equality are central to democratic participation (Verba et al., 1995).

Contrary to earlier research indicating that information sentiment has a substantial impact on governmental responses (Su & Meng, 2016; Yuan & Shen, 2024), our findings suggest that effective participation was not influenced by opinion sentiment. On the one hand, this may be due to the overall negative sentiment of public opinions in this study (Figure 3a), which has meant that differences in sentiment are insignificant. Additionally, the presence of established response mechanisms in many of the areas examined, as highlighted by our analysis of institutional contexts, may play a crucial role, as these mechanisms are designed to ensure that governments takes into account all public messages equally, regardless of sentiment (Meng & Yang, 2020). Thus, even when most opinions are negative, the relevant authorities must respond in a standardised and unified manner.

5.2 Context: Areas with a better built environment do not have a significantly better responsiveness regarding urban governance enquiries

The analysis indicated that areas experiencing rapid economic growth exhibited a greater level of public e-participation and government responsiveness, with urbanisation-related issues being more strongly represented in public opinions. This trend aligns with research conducted by Zhang et al. (2021), which highlights the challenges of urban decay and the necessity for revitalisation in economically dynamic areas. It was also found that areas with better institutional and economic environments generally showed a more effective response rate. This aligns with findings of Dong et al. (2011) and Balla (2011) and could be associated with the influence of accountable governance in those areas.

Nevertheless, areas characterised by a higher-quality built environment were less likely to show effective participatory outcomes, as evidenced by the low response rate and prolonged response time. One possible explanation is that people in these areas typically have higher educational attainment levels, potentially leading to increased political participation and elevated expectations regarding the potential of public opinion to enhance governmental policies (Le & Nguyen, 2021). This dynamic may be further reinforced by a reduced sense of governmental urgency in addressing local issues, a pattern seen in developed U.S. contexts where well-maintained infrastructure correlates with a lower perceived need for administrative intervention (Trounstine, 2020).

A noteworthy finding emerges from the divergent trends between economic and built environment metrics – two factors typically assumed to correlate positively. Based on our entropy scoring methodology, our longitudinal analysis (2011–2021) reveals distinct provincial patterns: while economically advanced provinces like Guangdong, Jiangsu and Zhejiang showed parallel development in both dimensions, others exhibited stark disparities. For instance, Shanghai and Hunan maintained strong economic performance but lagged in overall built environment quality, whereas Beijing and Liaoning presented the inverse pattern. These variations in contextual factor alignment help explain the observed differences in participatory outcomes across regions. These variations in contextual factor alignment help explain the observed differences in participatory

outcomes across regions, mirroring subnational disparities seen in federal systems where persistent economic-bureaucratic misalignment occurs (Bussell, 2019).

5.3 Actor: Primary-level government shows better responsiveness than the top levels of government hierarchy

In contrast to the established idea that eastern regions of China might show better government response rates because of their more advanced economic development, the present study found that public opinions posted from western regions were more likely to receive an effective response. These variations are affected by regional differences in territorial structures, governmental expenditure and ICT diffusion (Balla, 2011; Meng & Yang, 2020). Additionally, governments in western regions may also encounter a comparatively low volume of online requests and public opinion pressures (as shown in Figure 3c). This could be attributable to a lack of awareness regarding participation possibilities in these areas, which may result in enhanced responsiveness performance. This highlights the necessity of region-specific strategies to improve public e-participation in urban governance, taking into account the unique challenges and developmental trajectories of each region.

Our research also shows that lower-level governments are more likely to respond to public opinions regarding urban planning issues. This disparity can be attributed to the divergent motivations driving the response behaviours of governments at different hierarchical levels. This is consistent with stakeholder theory and political cost theory, which confirm that larger local governments disclose more information to satisfy the information needs of a greater number and variety of stakeholders who demand high levels of transparency, and to mitigate external pressure and political costs (Freeman, 1984). The results are also in line with the findings of Tejedo-Romero et al. (2022), who state that e-government tends to minimise citizens' information costs, allowing the emergence of new vertical and horizontal accountability mechanisms. Notably, the responsiveness of lower-level government is not autonomous but rather subject to the regulations imposed by higher-level government. In sociopolitical contexts characterised by stringent control exerted by higher-level government over local authorities, local government is frequently subjected to rigorous supervision

and inspection by central authorities (Imperial, 2021; Zhao, 2015). This situation exacerbates the pressure felt by lower-level government to respond promptly to expressed opinions and take corresponding action.

5.4 E-participation effectiveness: Presence and quality of response

This study centred on government responsiveness to evaluate e-participation effectiveness, departing from prior outcome-based paradigms that prioritise subjective satisfaction metrics, policy change and resource allocations (Brown & Chin, 2013; Hu et al., 2020; Karkin & Cezar, 2024; Kreusslein & Günther, 2024; Roberts & Kim, 2011). This responds to three practical challenges: the absence of clear user profiles and the challenge of gathering direct citizen satisfaction data (Chen et al., 2016; Distelhorst & Hou, 2014), limited traceability between citizen inputs and policy adjustments in bureaucratic systems (Schwanholz et al., 2021), and attribution ambiguities arising from temporal lags and external factors like fiscal constraints and political priorities (Kunc, 2018). Responsiveness establishes a directly observable linkage between citizen input and institutional reaction, functioning as a critical indicator mediating between participatory processes and societal outcomes. Compared to culturally sensitive satisfaction metrics or opaque policy-impact assessments, this framework offers enhanced cross-context applicability.

However, our findings reveal complexities even within this metric of responsiveness. Similarly to prior studies, we observed selective responsiveness, where governments prioritise certain types of messages, and variations in response quality related to delays or templated replies (Chen et al., 2016; Su & Meng, 2016). In addition, the patterns of response timeliness and response presence also vary across provinces due to differences in the information, context and actor factors. These variations underscore the fact that while responsiveness provides a valuable, cross-culturally applicable starting point for research in this area, its manifestation is context-dependent. These patterns suggest that using a single dimension of responsiveness is insufficient and might lead to bias; future work could bridge these paradigms, enriching understanding of effective e-participation via discourse analysis of response content.

5.5 Implications for urban governance theory

This study expands on Healey's (1996) communicative planning theory by adapting it to contemporary e-participation in urban governance contexts – addressing a gap in a theory originally formulated at a time when digital engagement technologies were limited. Drawing on persuasion theory, we developed a novel tripartite framework integrating factors of information, context and actor, moving beyond traditional one-dimensional assessments of effectiveness in urban governance contexts. Further, we adapted and operationalised concepts from government responsiveness theory, originally developed and made prominent in political science, by incorporating indicators (presence and quality) for the analysis of governmental response to public input. By applying this theory to the domain of public participation and positioning responsiveness as a mediating indicator linking participation processes to societal outcomes, we extend its scope of application beyond political science.

This integrated approach delivers a practical diagnostic tool for urban governance scholarship and practice, directly tackling the fundamental policy challenge of balancing participatory ideals with bureaucratic efficiency – a tension acutely intensified by selective responsiveness risks in digitally transforming governance systems. The demonstrated efficacy of mechanisms like China's Online Message Board for Leaders provides empirical grounding for global adoption, as governments worldwide increasingly deploy diverse e-participation tools – from petition platforms to social media interfaces and online support systems (United Nations Department of Economic and Social Affairs, 2020). In this context, the proposed tripartite framework and its associated responsiveness evaluation metrics offer a universal analytical toolkit for designing and assessing such mechanisms.

5.6 Implications for urban governance policy and practice

This research delivers actionable insights for enhancing participatory governance across local and global contexts. While platforms like China's Online Message Board for Leaders demonstrate potential, their current transactional design – limited to single-cycle information exchange – constrains participation to basic e-consultation, falling short of collaborative decision-making (United Nations, 2014). Effective participatory governance requires policy frameworks that

explicitly foster dynamic interaction between governmental entities and the public, as meaningful progress hinges on coordinated efforts from both sides.

The empirical evidence underscores the importance of information, in different aspects, in enhancing participatory equity. Governments should proactively address historically neglected issues such as wage arrears in construction projects and illegal building. This will necessitate the implementation of algorithmic equity audits for participation platforms in order systematically to identify underrepresented topics, coupled with the establishment of mandated response protocols for high-priority issues. Cross-departmental task forces should be tasked with resolving complex cases, supported by public dashboards that track resolution progress in real time. On an international scale, the approach for identifying topic-based participation gaps provides various governance systems with a transferable model to create localised priority registries, facilitating context-specific equity adjustments across different socioeconomic environments.

Regarding the role of context, the results show that areas with better institutional and economic environments demonstrated superior performance in delivering effective responses compared to those with less favourable contextual environments. This highlights the need for domestic reforms to establish tiered digital infrastructure funding, allocating resources to under-resourced areas via quantifiable inclusivity metrics. Concurrent mobile-based micro-training for officials in low-capacity regions would strengthen governance foundations. Globally, development initiatives should prioritise asymmetric capacity-building over standardised platform deployment, tailoring interventions to local strengths and deficiencies rather than enforcing uniformity. This will ensure resource allocation aligns with capacity benchmarks, adapts to diverse realities and fosters equitable and sustainable development across socioeconomic contexts.

Concerning the place of actors, governments at different administrative levels and in different regions exhibited different patterns in dealing with public e-participation. Domestically, standardising core protocols while allowing localised adaptations can resolve these disparities, thereby enhancing transparency and trust. Internationally, the empirical insights carry particular

significance for federal systems and decentralised states, providing a diagnostic analytical framework to map existing governance configurations prior to the implementation of e-governance interventions. By aligning digital tools with pre-existing institutional structures and power distribution mechanisms, governments can develop more effective, contextually sensitive systems that reconcile national policy priorities with regional implementation realities.

To enhance participatory outcomes, citizens should refine their communication strategies by prioritising actionable topics and submitting their opinions in concise, policy-focused form. Public awareness campaigns can support these practices while reducing administrative burdens. To complement such efforts, governments could develop Citizen Communication Toolkits (World Bank Group, 2025) , including guides for topic prioritisation and template builders to ensure clarity. However, achieving meaningful public engagement faces systemic barriers. As observed in e-governance contexts, low participation often stems from trust deficits or perceived risks around data privacy or technical uncertainties (Cui et al., 2022). These challenges highlight the fact that achieving effective e-participation will mean not only refining citizen communication, but also proactively addressing multidimensional trust and accessibility barriers.

6 Conclusions

Understanding how to enhance public e-participation effectively is essential for accountable digital governance in cities, yet this question remains underexplored. Prior research has predominantly examined isolated dimensions of participation effectiveness while lacking integrated analytical frameworks. Addressing this gap, this paper has brought together factors of information, context and actor, combining persuasion theory with a government responsiveness metric. Analysing 11 years of citizen–government interactions on China's Government Online Message Board, we empirically establish that all three dimensions have a significant influence on response rate and timelines. This empirically validated framework advances scholarly understanding of e-participation effectiveness while offering actionable pathways for accountable digital governance.

The limitations of this study lie in the following aspects. First, the unique cultural and political

context of China's Government Online Message Board system limits its direct applicability to other regions, suggesting the need for comparative cross-national studies of e-participation platforms. Second, while we assessed responsiveness through presence and timeliness metrics, future research should expand the evaluation to include multi-dimensional response quality, public satisfaction rates and longitudinal tracking of request frequency and recurrence rates. Third, methodological constraints emerge from our panel data analysis: while the analysis successfully takes into account geographic disparities across provinces, the temporal dimension remains underexplored. Implementing dynamic panel models would help to address these spatiotemporal dynamics more comprehensively. Fourth, privacy protections preventing access to users' socio-demographic data have precluded analysis of the influence of communicator characteristics. This could comprise an important avenue for future investigation. Finally, the predominance of negative sentiments in our dataset limited the analysis of the significance of sentiment; subsequent studies should examine emotional intensity as a potential moderating variable.

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