The persuasive role of the past: Policy feedback and citizens' acceptance of information communication technologies during the COVID-19 pandemic in China

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Abstract
How can the enforcement of policies in the past influence a society's future adoption of information communication technologies (ICTs)? In this paper, we tackle this question by exploring how past e-governance policies influence citizens' willingness to use the health QR code, which is a COVID-19 tracing app widely used in China's pandemic control. Past policies regarding smart-city development in China involve two aspects: the construction of electronic infrastructure and the applications of specific technologies. Empirical analysis based on a nationwide dataset in China suggests that past policies exhibit persuasive effects and influence citizens' acceptance of the health QR code. Specifically, e-governance applications in cities significantly enhance citizens' acceptance through the demonstration of their usefulness. However, the construction of e-governance infrastructure per se does not have the same impact on citizens' acceptance. By connecting citizens' acceptance of new technology with past e-governance policies, the study illustrates a nuanced policy feedback mechanism through which past policies can substantially reshape public opinion by policy outcomes.

Keywords
policy feedback, China, ICTs, health QR code
INTRODUCTION

Information and communication technologies (ICTs) are used by public sectors around the world and have a significant influence on public management practice in various areas (Kudo, 2008; Meijer & Rodríguez Bolívar, 2016; Xia, 2017), particularly urban governance (Allam & Dhunny, 2019; Pereira et al., 2017). With the rapid diffusion of ICTs in the public sector, scholars have found that the public acceptance of ICTs greatly influences the effectiveness of public management reform (Allam & Dhunny, 2019; Salvia & Morello, 2020). Acceptance can be determined by several factors. Davis (1989) proposes the Technology Acceptance Model (TAM) to explain the characteristics of the public acceptance of ICTs and proposed that two factors, perceived usefulness and perceived ease of use, influence this acceptance. Over the past decades, many studies have used the TAM to explain citizens’ attitudes and behaviors toward ICTs in the context of public management and attempted to understand citizens’ acceptance of the ICTs adopted by public sectors (e.g., Guner & Acarturk, 2020; Mensah, 2020; Teeroovengadum et al., 2017). Previous studies have mainly investigated the explanatory factors influencing the public acceptance of ICTs from micro-individual perspectives, such as citizens’ attitudes toward technologies and their trust in developers. To the best of our knowledge, however, little research has focused on the influences of macro-level factors, such as the government’s institutional and policy choices, on citizens’ acceptance of ICTs.

Historical institutionalist scholars have long suggested that individuals’ opinions and behaviors are shaped by institutions (Pierson, 1993; Skocpol, 1992; Steinmo et al., 1992). Within policy science, the policy feedback literature views past policies as “causes” and has elaborated upon the effects and mechanisms through which public policies shape citizens’ behavior in the policy process (e.g., Fernández & Jaime-Castillo, 2013; Polman & Alons, 2021; Schmid et al., 2020). Following this line of thought, the present study aims to explore the roles of past policies in the formulation of citizens’ acceptance of ICTs. Specifically, we address this question from a unique perspective by examining how the past policy outcomes of local-level e-governance can shape citizens’ acceptance of ICT-based tools during the COVID-19 pandemic, as well as their support for the future use of these tools after the crisis.

We take ICTs implementation during the COVID-19 pandemic as our study context and test how the past e-governance policies influence citizens’ acceptance of China’s health QR code. The health QR code is a kind of ICTs that has played a critical role in helping China prevent and control COVID-19, as well as in the state’s efforts to resume work, production, and business activities (Guo et al., 2022; Hua & Shaw, 2020). This QR code is an extension attached to the mobile payment apps WeChat and Alipay and works by tracking the holder's activity to analyze one's risk of infection. The health QR code display green, yellow, or red respectively according to the user's calculated risk of infection. Specifically, a green code indicates low risk and allows the user access to public places and transportation, while a yellow or red code indicates that the holder has a risk of infection and must undergo medical testing for further confirmation.

During the pandemic, many countries including Russia, Australia, and Singapore have started to use similar trajectory tracking apps to control infection (Goggin, 2020). While effective in certain dimensions, health QR code systems have also faced some controversy. For example, the effective operation of health QR codes relies on real personal identification and geographic location information, resulting in privacy issues (Han & Deng, 2020). The health QR code has also been marred by the controversy of a digital divide since it has been shown that the elderly find it difficult to use (Wang & Jia, 2021). Shklovski et al. (2010) highlight that crises can drive governments to develop new ICTs for use in public management and provide an opportunity to examine citizens’ acceptance of ICTs in this context. The diffusion of the health QR code has been widespread in China during the COVID-19 pandemic, with over a billion citizens using it. The technology has almost achieved full coverage of
internet users in the country. As such, it provides an important opportunity to understand citizens' perceptions and acceptance of ICTs in the public management field during a crisis.

The health QR code is a typical case of e-governance through the adoption of ICTs in the public management field. During the past 10 years, the Chinese government has launched many policy projects driven by ICTs to promote public management reform. Particularly, in 2014, the State Council of China issued the National New Urbanization Plan (2014–2020; NNUP), and the Chinese government began to vigorously promote the construction of smart cities based on ICTs to optimize government functions and enhance the quality of public services. The NNUP emphasizes that smart city construction in China should focus on (1) internet infrastructure to ensure the availability of digital resources and (2) digitizing public services to optimize the development and use of public resources (State Council of the PRC, 2014). In the five years after the implementation of the NNUP, China's internet penetration rate has risen from 48.8% to 67% (CNNIC, 2020). Meanwhile, local governments have made efforts to promote smart cities around China (Shen et al., 2018). Public management reforms supported by ICTs have also emerged at the local level, especially in urban governance (Lin, 2018; Zhen et al., 2015). The level of e-governance development is influenced by local technology, economic resources, education levels, and urbanization rate (Wu & Bauer, 2010). After the release of the NNUP, local jurisdictions in China proposed their own smart city development plan. The significant increase in e-governance provides a digital environment that is conducive to the widespread application of emerging ICTs in smart city construction. In addition, it also allows for a comparison of citizens' acceptance of new ICT-based tools in city governance using the specific example of the health QR code.

The policy practices described above facilitate our exploration of the effects and mechanisms through which past e-governance policy outcomes have influenced citizens' acceptance of ICTs. To do so, we build a comprehensive theoretical framework by combining the TAM with policy feedback theory to understand how individuals' perceptions of ICTs are influenced by macro-level policy outcomes. The remainder of this paper is organized as follows. Section 2 reviews the extant literature on the TAM and policy feedback theory and proposes the main hypotheses. Section 3 outlines the research design and presents the methods used for data collection and analysis. Section 4 reports the empirical results. Finally, Section 5 concludes with a discussion of the results and the implications for future research.

LITERATURE REVIEW

Citizens' acceptance of ICTs

The TAM, proposed by Fred D. Davis in 1989, is a widely used theoretical framework for predicting the public acceptance of ICTs. According to this model, individual acceptance depends on public intention to use the technology, which is influenced by its perceived usefulness and perceived ease of use. Perceived usefulness refers to "the degree to which a person believes that using a particular system would enhance his/her job performance," and perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989).

Driven by big data technology, ICTs that collect and analyze citizens' personal information and data on their behaviors are increasingly used in public management. The wide applications have brought out concerns about privacy, which is a focal issue in the ICTs acceptance research (Braun et al., 2018; Schomakers et al., 2021). When faced with a new surveillance technology that collects private personal information, such as biometric and location data, people tend to oppose the diffusion of its application (Vandercruysse et al., 2020; Zhou, 2011). Therefore, empirical scholarship shows
that privacy concerns reduce citizens’ acceptance of ICTs (Bromberg et al., 2020; Dong et al., 2017; Reddick et al., 2015).

Recent studies point out the privacy concerns when using health QR code, especially for its function of collecting and analyzing users’ trajectory data to track possibly infected individuals (Guo et al., 2022). During crises, individuals may choose to give up some of their privacy (Hiller & Russell, 2017), in exchange for benefits such as increased security (Ioannou & Tussyadiah, 2021), and may even sacrifice privacy to gain the benefits offered by ICTs (Friedewald et al., 2017). Citizens’ trust in governments can increase significantly as governments deal with crises more effectively (Horvath et al., 2020). Therefore, it suggests that the adverse effect of the privacy concern may be mitigated by the government’s behavior in times of crisis. In other words, during the crisis period, citizens may allow public sectors to access and analyze their private data for increased safety (Belle et al., 2021).

The TAM provides a useful analytical framework for understanding citizens’ acceptance of ICT-based tools by focusing on individual perceptions of these tools, for example, their perceived usefulness and perceived ease of use, as well as privacy concerns. Some TAM studies have proposed that it is necessary to go beyond individual perceptions by exploring social context factors, such as social norms, to explain citizens’ acceptance of ICTs (Venkatesh & Davis, 2000; Yoon, 2018); however, it remains unclear how macro-environmental factors, particularly public policies, shape this acceptance. In the context of the wide application of ICTs in the public management field, it is essential to understand the role of public policies in the formulation of citizens’ acceptance of them.

Policy feedback: How external policies influence citizens' acceptance

In the past decades, policy science scholars have considered public policy as both an effect and a cause in order to determine its role in political change through influencing policy actors. Following the historical institutionalist approach, policy feedback theory was developed to explore the mechanisms through which public policies influence policy actors (e.g., Campbell, 2012; Mettler & Soss, 2004; Moynihan & Soss, 2014; Pierson, 1993). Policy feedback theory emphasizes the relationships between public policies and policy actors in the long-term and focuses on how past policies change the perceptions and behaviors of multiple actors, including policymakers, citizens, and interest groups, and, thus, influence future policy change (Campbell, 2012; Mettler & Soss, 2004; Pierson, 1993; Sabatier & Weible, 2014). According to policy feedback theories, during the policy process, public policy may bring about unintended effects beyond its intended goals and has the function of shaping people’s thoughts and behaviors (Pierson, 1993).

Numerous policy feedback studies have focused on the relationship between public policies and citizens and have explored how such policies influence and even shape public opinion (e.g., Jacobs et al., 2021; Larsen, 2019; Mettler & Soss, 2004). Policy feedback occurs through the intervening influence of resource and interpretive effects on public opinion (Campbell, 2012; Mettler & Soss, 2004; Schneider & Ingram, 1993; Soss & Schram, 2007). The resource effect occurs when policy influences public opinion through the resources created by the policy, for example, salaries, commodities, services, education, and other material resources (Mettler, 2002). The interpretive effect emphasizes that public policies establish rules and procedures for the public throughout the process of policy design and implementation while further impacting public opinion and behaviors (Mettler, 2002; Mettler & Soss, 2004; Patashnik & Zelizer, 2013; Schneider & Ingram, 1993). Together, resource and interpretive effects create two possible feedback outcomes: self-reinforcing as a form of positive feedback, and self-undermining as a form of negative feedback. Self-reinforcing creates benefits for the public, provides a better understanding of policies (Svallfors, 2007), increases the cost of policy change, leads
to policy continuation in the next decision-making process (Fernández & Jaime-Castillo, 2013), and creates path-dependence. Self-undermining undermines this path-dependence and triggers policy change (Jacobs & Weaver, 2015; Streeck & Thelen, 2005; Tang et al., 2018). Self-reinforcing and self-undermining coexist and compete with each other to determine the ultimate feedback effect (Daniel et al., 2019; Tang et al., 2018; Weaver, 2010).

Policy feedback theory helps to understand how past policies influence citizens’ acceptance of ICTs in the public management field. Recent policy feedback theory research has emphasized the necessity of making a distinction between truly exogenous policy factors and policy outcomes (Schmid et al., 2020). Importantly, policy outcomes should not be understood as “shocks” but rather as an integral part of long-term feedback loops among policy, policy outcomes, and subsequent politics (Schmid et al., 2020). Instead of making comprehensive tests of the policy feedback theory, we focus on a specific aspect of the interactions, i.e., the effect of policy outcomes on public opinion. Namely, we focus on the mechanisms through which the past e-governance promoting policies in China affect individuals' acceptance of ICTs during the COVID-19 pandemic.

Hypotheses

Institutionalism studies have highlighted that public policies influence individuals’ behavior through consciousness and cognition (Berger & Luckmann, 1966; Pillay et al., 2017). The large-scale rollout of the health QR code during the COVID-19 pandemic allows us to explore how the NNUP, including its e-governance policies, influences citizens’ acceptance of ICTs. The NNUP sets out the requirements and guidelines for the development of smart cities in China in terms of both e-governance infrastructure and e-governance application such as city planning, city services, and social governance (State Council of the PRC, 2014).

The NNUP requires city governments to ensure full coverage of the fixed and mobile Internet by the end of 2020 (State Council of the PRC, 2014), which means easier access to online service resources for citizens. With the continuous efforts of city governments, two-thirds of Chinese citizens have already connected to the Internet, and Internet traffic has surged from 8.89 to 74.5 billion GB (CNNIC, 2020). Previous studies show that the construction of these infrastructures could provide more information, services, and chances for citizens to participate in governance (Rawat, 2021). In line with policy feedback theory, e-governance infrastructure may cause a resource effect on citizens’ acceptance of ICTs in the public management field. Thus, we propose our first hypothesis.

**Hypothesis 1** Citizens’ acceptance of the health QR code during the COVID-19 pandemic (resource effect) is increasing with the city’s e-governance infrastructure level.

The NNUP also encourages local governments to undertake reforms based on ICTs through the application of e-governance platforms in policy domains such as education, medical and social security (State Council of the PRC, 2014). In the 13th five-year development after the NNUP announcement, an increasing number of Chinese citizens have adapted to the more convenient online life. For example, 29.4% of Chinese Internet users have tried online medical services, 40.5% of them have utilized online education services, and for online payments, the proportion even reached 85.7% (CNNIC, 2020). These ICT-based applications could make citizens perceive more benefits of e-governance in their daily life (Guner & Acarturk, 2020). Moreover, it could shape citizens' attitudes toward online participation (Rawat, 2021), and even lead to a greater dependency on ICTs (Salvia & Morello, 2020). Namely, there is an interpretive effect on citizens' acceptance through the lens of e-governance applications. Accordingly, we propose the following hypothesis.

**Hypothesis 2** Citizens’ acceptance of the health QR code during the COVID-19 pandemic (interpretive effect) is increasing with the city’s e-governance application level.

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DATA AND MEASUREMENTS

The data for our empirical analysis are mainly drawn from a large-scale online questionnaire survey of citizens living in 25 major cities in mainland China, including four provincial-level municipalities (Beijing, Shanghai, Tianjin, and Chongqing) and 21 provincial capital cities among the top 100 cities in terms of GDP. We conducted our survey from May to June 2020. Our targeted respondents are residents who have primarily lived in the same city since January 2020 to ensure that the collected data accurately reflects their experiences and perceptions of the government responses to the COVID-19 pandemic. It is necessary to rely on an online survey for data collection due to ongoing travel restrictions. We follow a quota sampling method: In each city, we recruit 100 participants based on a quota structure that reflected the population structure by age, gender, and hukou status in the city. We conduct detailed data cleaning and removed responses that included inconsistent personal information or suspicious answers (e.g., choosing the same answer for a range of Likert-scale matrix questions), ultimately obtaining a sample of 2114 valid responses.

Two questions in the survey relate to the key dependent variables. The first is, “What is your attitude to the government’s implementation of the health QR code policy?” We use the variable “Current Acceptance” to capture the responses to this question, which take a value of 1 (complete objection), 2 (relative objection), 3 (indifference), 4 (relative support), or 5 (complete support). The second question is, “After the pandemic (when the government announces that the crisis has ended), would you support the government’s continued implementation of the health QR code policy for public health issues?” We use the variable “Future Acceptance” to capture the responses to this question, which take a value of 0 (objection) or 1 (support). Since it is possible that citizens’ support for the QR code may not completely transition to future support, it is useful to distinguish attitudes toward the current stage of implementation from those regarding future implementation.

To assess the policy feedback effects, we propose two main independent variables based on Hypotheses 1 and 2: “E-governance Infrastructure” refers to the level of digital infrastructure construction in cities, and “E-governance Application” refers to the application level of e-governance in the fields of administrative services, public services and citizen’s daily-life services. The data for these two variables is taken from the City E-governance Report of China 2020 issued by the China Economic Information Service, China Information Industry Association, and China Academy of Urban Planning & Design (CEIS et al., 2020). This comprehensive assessment reports on the level of e-governance in Chinese cities, and its assessment indexes are basically in line with the NNUP (Table A1). We use the “digital infrastructure index” in this report to measure the “E-governance Infrastructure” variable. The average scores of the “digital administrative service index,” “digital public service index,” and “digital daily-life service index” are combined to form the “E-governance Application” variable (Table A2 and Figure A1). The summary of statistics for the main variables is presented in Table 1.

Furthermore, we introduce additional control variables to capture city-level time-invariant features, including the variables describing the level of a city’s urbanization, such as GDP, population, number of universities, share of industry in GDP, proportion of the built-up area of the city, and a region dummy indicating the city location in China (eastern or not). All the information is from the China City Statistical Yearbook 2020 (National Bureau of Statistics of China, 2020). In addition, we also control COVID-19 confirmed rate (as of June 1st 2020).
EMPIRICAL RESULTS

We test our hypotheses using the ordered logistic regression model. For the comparison of citizens' acceptance of the health QR code during and after the COVID-19 pandemic, we explore the reliability of each research hypothesis with the two dependent variables separately. We use “Current Acceptance” (i.e., citizens' acceptance of the current use of the health QR code during the COVID-19 pandemic) as the dependent variable and conduct a multiple OLS regression analysis (see Table 2). Thereafter, we use “Future Acceptance” (i.e., citizens' acceptance of the future use of the health QR code after the COVID-19 pandemic) as the dependent variable and conduct an ordered logistic regression analysis because the dependent variable is binary (see Table 3).

In Table 2, the dependent variable is citizens' acceptance of the current use of the health QR code during the COVID-19 crisis. In Model 1, the independent variables are control variables. In Model 2, we add TAM variables including Perceived Usefulness, Perceived Ease of Use, and Privacy Concerns. In Model 3 we add E-governance Infrastructure and E-governance Application to test Hypotheses H1 and H2.

The results of Model 2 show that both perceived usefulness and perceived ease of use positively and significantly affect the acceptance of the current use of the health QR code during the COVID-19 crisis. Privacy Concerns significantly and negatively affects the acceptance of the current use of the health QR code. Model 3 shows that E-governance Application significantly and positively affects the acceptance of the current use of the health QR code during the crisis, supporting Hypothesis H2. However, E-governance Infrastructure does not significantly influence respondents' acceptance of the health QR code's use during the crisis. In addition, individual characteristics such as experience of living abroad and identity significantly influence individual acceptance of the technology.

In Table 3, the dependent variable is “Future Acceptance.” Model 4 includes only control variables. In Model 5, we add Perceived Usefulness, Perceived Ease of Use, and Privacy Concerns; and we add E-governance Infrastructure and E-governance Application in Model 6 to further test Hypotheses 1 and 2.

The results of Model 5 indicate that Perceived Usefulness positively and significantly affects citizens' acceptance of the future use of the health QR code. The technology's Perceived Ease of Use

| Variables                          | Mean | Std. dev. | Min | Max |
|------------------------------------|------|-----------|-----|-----|
| Individual variables (N = 2114)    |      |           |     |     |
| Current Acceptance                 | 4.40 | .77       | 1   | 5   |
| Future Acceptance                  | .75  | .43       | 0   | 1   |
| Perceived Usefulness               | 4.21 | .74       | 1   | 5   |
| Perceived Ease of Use              | 4.31 | .79       | 1   | 5   |
| Privacy Concerns                   | 2.88 | 1.27      | 1   | 5   |
| Gender (1 = male, 0 = female)      | .51  | .50       | 0   | 1   |
| Age                                | 38.81| 14.92     | 18  | 75  |
| Education                          | 3.54 | .83       | 1   | 5   |
| CCP Membership (1 = yes, 0 = no)   | .17  | .37       | 0   | 1   |
| Exp Abroad (1 = yes, 0 = no)       | .14  | .35       | 0   | 1   |
| City-level variables (N = 25)      |      |           |     |     |
| E-governance infrastructure         | .22  | .12       | .06 | .52 |
| E-governance application            | .44  | .21       | .15 | .99 |

TABLE 1 Summary of statistics for the main variables
does not significantly influence citizens’ acceptance of the future use of the health QR code; however, Privacy Concerns significantly and negatively affect this acceptance. In Model 6, E-governance Infrastructure significantly reduces citizens’ acceptance of using the health QR code in the future, failing to support H1. Moreover, E-governance Application significantly improves their acceptance of this technology, supporting H2. In terms of control variables, citizens’ education levels have a negative and significant effect when the independent variables are added into the regression, indicating that educational attainment significantly reduces citizens’ acceptance of the future use of the health QR code.

To summarize the results in Tables 2 and 3, we find that Perceived Usefulness and Privacy Concerns have significant effects on citizens’ acceptance of both the current and future use of the health QR code in China. Perceived Ease of Use has a significant positive effect on the acceptance of the current use of the health QR code but does not have the same impact on the acceptance of its future use. Notice that there will be few extra costs of learning for citizens to use the health QR code after the pandemic. Therefore, the Perceived Ease of Use does not significantly influence citizens’ acceptance of health QR code after the pandemic in the regression.
**DISCUSSION AND CONCLUSIONS**

Beyond its contribution to understanding citizens’ acceptance of ICTs in the public management field from a policy perspective, this study demonstrates how past policies can shape public opinion in the policy process through the feedback effects of the outcomes of past policies. With the implementation of the e-governance policy under China’s NNUP, the level of e-governance infrastructure and application across the country have been improved dramatically in the past five years. To explore the impact of e-governance policy on citizens’ acceptance of ICTs in the public management field during times of crisis, we take the health QR code implemented during the COVID-19 pandemic as an example of an ICT-based governance tool. Based on the TAM and policy feedback theory, we propose hypotheses to test how e-governance policy influences citizens’ acceptance of ICTs in the public management field. Our results demonstrate that the TAM could explain the mechanisms that shape citizens’ acceptance of ICTs

| TABLE 3 Main results (ordered logit) |
|-------------------------------------|
| **Explanatory variables**            |
| E-governance infrastructure       | Model 4 future acceptance | Model 5 future acceptance | Model 6 future acceptance |
| E-governance application           |                          | 1.07**                     | (0.47)                    |
| Perceived usefulness              | .66***                    | .65***                     |
|                                   | (0.10)                    | (0.10)                     |
| Privacy concerns                  | −1.25***                  | −1.25***                   |
|                                   | (0.16)                    | (0.16)                     |
| Perceived ease of use             | .06                       | .07                        |
|                                   | (0.08)                    | (0.08)                     |
| **Control variables**              |
| Gender                            | −.10                      | −.05                       | −.04                      |
|                                   | (.13)                     | (.14)                      | (.14)                     |
| Age                               | −.01                      | .003                       | .004                      |
|                                   | (.02)                     | (.03)                      | (.03)                     |
| Age_squared                       | .0002                     | .0001                      | .0004                     |
|                                   | (.0003)                   | (.0004)                    | (.0004)                   |
| Education                         | −.08                      | −.16**                     | −.16**                    |
|                                   | (.05)                     | (.07)                      | (.08)                     |
| CCP Membership                    | .26**                     | −.02                       | −.02                      |
|                                   | (.11)                     | (.17)                      | (.17)                     |
| exp abroad                        | −.75***                   | −.17                       | −.17                      |
|                                   | (.16)                     | (.18)                      | (.19)                     |
| City-level controls               | Y                         | Y                          | Y                         |
| Observations                      | 2114                      | 2114                       | 2114                      |

*Note: Robust standard errors adjusted by city clusters are reported in parentheses.

***p < .01.

**p < .05.

*p < .1.
in the public management field in a crisis setting, which is consistent with the findings of many studies conducted in non-crisis settings (e.g., Guner & Acarturk, 2020; Yoon, 2018). During a crisis, citizens still consider the usefulness and ease of use of ICTs, which affects their acceptance of ICTs. Particularly, we find that privacy concerns significantly and negatively affect citizens' acceptance of the health QR code during the pandemic.

As above mentioned, previous studies on citizens' acceptance of ICTs have mainly focused on individual perception factors and have ignored the role of the external institutional environment. We find that citizens' acceptance of ICTs in a crisis is influenced by individual perceptions of ICTs, including their perceived usefulness, perceived ease of use, and privacy concerns. We also contribute to the elaboration of how past policies, as institutional environments, influence citizens' acceptance of ICTs in the public management field. Our results demonstrate how the different outcomes of past e-governance policies, applications, and infrastructures induce different policy feedback effects on citizens' acceptance of the health QR code. The outcomes of e-governance applications at the city level can be persuasive and increase citizens' acceptance of ICTs through the interpretive effect, while the resource effect brought about by the level of e-governance infrastructure outcomes at the city level does not have a significant impact.

Increased e-governance application in public management implies the implementation of an easier digital lifestyle, which influences citizens' acceptance of ICTs through interpretive effects. The crux of the interpretive effect is that policies change public perceptions through information transmission (Pierson, 1993). Digital transition in citizens' social lives could help them realize that ICT-based governance tools could afford them more convenience and efficiency than traditional governance tools, directly influencing their acceptance of the health QR code during the COVID-19 crisis. Meanwhile, e-governance capacity could affect public trust in government (Kirs & Bagchi, 2012; Myeong et al., 2014). Citizens believe that the health QR code implies a stronger government capacity and lower costs for personal protection, which creates a significant effect of e-governance application on citizens' acceptance of this technology.

However, the resource effect on e-governance infrastructure is not found to be significant. Our findings show that the level of e-governance infrastructure does not affect citizens' acceptance of the use of the health QR code during the COVID-19 pandemic and negatively affects their acceptance of its future use after the pandemic. These results suggest that public perceptions of ICT-based governance tools are more influenced by the level of e-governance application in a crisis. Moreover, the improvement of e-governance infrastructure brings about an expansion of the public space and a contraction of the private space (Nissenbaum, 1998), causing privacy concerns among citizens (Dinev et al., 2008). Therefore, our findings could demonstrate that the resource effect of e-governance infrastructure is counteracted by individuals' privacy concerns regarding the health QR code, resulting in a non-significant relationship with their acceptance of this technology. In addition, recent studies have shown that the feedback of a policy goes beyond the distinction between positive and negative (Daugbjerg & Kay, 2020; Polman & Alons, 2021), meaning that the ultimate feedback may contain conflicting formation paths. We believe the inconsistent results regarding the resource effect and interpretive effect demonstrate the complexity of the overall policy feedback effect.

Our results offer broad implications for e-governance practice during and after the COVID-19 pandemic. With the rapid development of e-governance in China, citizens are not only concerned with the usefulness of ICTs to promote convenience and effectiveness in public management but also their individual privacy. Consequently, policy practitioners should make more effort to protect privacy in the process of technology adoption. Our analysis also highlights the importance of e-governance application. Trustworthy e-governance should be achieved through its effective application in various
aspects such as providing high-quality public services, promoting government efficiency, transparency and responsiveness, rather than only relying on infrastructure construction.

Our study has several limitations. First, we use National New Urbanization Plan as a “past policy,” which is one of the most influential policies made by the central government to promote e-governance in China. However, many local governments developed local policies to promote e-governance in the past years. Therefore, the roles of local policies on citizens’ acceptance of ICTs need to be explored in the future. Second, we test the policy feedback effects on citizens’ acceptance of ICTs under a crisis. Citizens’ acceptance during the crisis may be influenced by some special factors of crisis perceptions, and individuals’ experiences during the COVID-19 pandemic. Thus, whether the findings extend without the crisis factors, especially in the long run, needs further investigation.

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**CONFLICTS OF INTEREST**

There are no conflicts of interest to declare.

**ETHICS STATEMENT**

This manuscript has not been published or presented elsewhere in part or in entirety and is not under consideration by another journal. All study participants provided informed consent, and the study design was approved by the appropriate ethics review board. We have read and understood your journal’s policies, and we believe that neither the manuscript nor the study violates any of these.

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## APPENDIX A

### TABLE A1  
E-governance performance indicators in *City E-governance Report of China 2020*

| Variables | Indexes | Indicators | Descriptions |
|-----------|---------|------------|--------------|
| E-governance Infrastructure | E-governance Infrastructure Index (Infrastructure construction) | Fixed Networks | Fixed-line Internet penetration rate |
| | | Mobile Networks | Mobile Internet penetration rate |
| | | Infrastructure Digitalization | Infrastructure digitization rate |
| E-governance Application | Digital Administrative Services Index (Administrative Application) | Information Disclosure | Government online disclosure level |
| | | City Brain | Application of City Administration System |
| | | Online Services | Governmental online service level |
| | Digital Public Services Index (Social Application) | Digital Social Insurance | Application of Social Insurance Platform |
| | | Digital Healthcare | Application of Digital Health Insurance Card |
| | | Digital Education | Application of Public Education Resources Platform |
| | | Digital Consumption | Application of Digital Coupons in economy |
| | Digital Daily-life Services Index (Personnel Application) | Digital Transportation | Traffic intelligence level |
| | | Digital Travel | Digital travel service coverage |
| | | Mobile Payment | Mobile payment coverage |
| | | Digital Bill Payment | Convenience of online bill payment |

### TABLE A2  
E-governance performance score in *City E-governance report of China 2020*

| City | E-governance infrastructure | E-governance application<sup>a</sup> |
|------|-----------------------------|-------------------------------------|
| Beijing | 0.5222 | 0.7419 |
| Shanghai | 0.4302 | 0.7585 |
| Tianjin | 0.1573 | 0.4346 |
| Shijiazhuang | 0.1659 | 0.4678 |
| Taiyuan | 0.2009 | 0.3899 |
| Huhehaote | 0.2318 | 0.1490 |
| Shenyang | 0.1185 | 0.2446 |
| Changchun | 0.0747 | 0.2672 |

(Continues)
| City       | E-governance infrastructure | E-governance application<sup>a</sup> |
|------------|-----------------------------|-------------------------------------|
| Harbin     | 0.0626                      | 0.2274                              |
| Nanjing    | 0.2430                      | 0.5696                              |
| Hefei      | 0.1484                      | 0.5104                              |
| Fuzhou     | 0.1883                      | 0.3343                              |
| Nanchang   | 0.1533                      | 0.3639                              |
| Jinan      | 0.1795                      | 0.3002                              |
| Changsha   | 0.2048                      | 0.2878                              |
| Nanning    | 0.1413                      | 0.2716                              |
| Chongqing  | 0.1858                      | 0.4265                              |
| Guiyang    | 0.1817                      | 0.2768                              |
| Kunming    | 0.1726                      | 0.1954                              |
| Guangzhou  | 0.5066                      | 0.6607                              |
| Lanzhou    | 0.1598                      | 0.1985                              |
| Hangzhou   | 0.3233                      | 0.9852                              |
| Chengdu    | 0.2613                      | 0.5845                              |
| Zhengzhou  | 0.2947                      | 0.7037                              |
| Xi’an      | 0.2309                      | 0.5945                              |

<sup>a</sup>E-governance Application is measured by the mean value of Digital Administrative Services Index, Digital Public Services Index and Digital Daily-life Services Index.

**TABLE A2** (Continued)

**FIGURE A1** E-governance development index score across cities.