



Research on Big Data Applications and Citizen Privacy Conflict Mechanisms in Public Service Digitalization

Hongyi Liu*

School of Management, Xi'an University of Finance and Economics, Xi'an, China

*1352695380@qq.com

Abstract. The digital transformation of public services has become a crucial pathway for enhancing government governance capabilities and optimizing citizen service experiences, yet it has also raised concerns among citizens regarding personal data privacy. To further explore the tension between public service digitization and citizens' apprehensions about its potential risks, a questionnaire survey was conducted among 500 Chinese citizens in a digital public service environment. This revealed their overall attitudes and specific concerns, with regression models analyzing the relationship between these factors. The innovation lies in understanding citizens' genuine attitudes toward public service digitization through a large-scale sample, with the regression analysis model validating the rationality of subsequent conclusions. The final research conclusion is that there is a significant correlation between the actual application level of public service digitization and citizens' attitudes toward it and their concerns about its potential risks. Governments still need to effectively integrate internal management and external oversight of public service digitization.

Keywords: Digitalization of Public Services, Citizen Attitudes, Risk Concerns, Regression Analysis.

1 Introduction

1.1 Problem Statement

The digital era is driving the continuous evolution of traditional governments into digital governments. The primary responsibility of government is to provide public services to society, and digital technology is rapidly digitizing these services. The digitization of public services not only enhances efficiency and expands coverage but also improves precision^{[1][2]}. Therefore, the development of digital public services requires the joint efforts of citizens and government. In enhancing the precision of public services, governments require the collection of citizen data. However, the mandatory nature of this process, coupled with a lack of transparency and individuals' inability to refuse data collection, has sparked widespread public concern regarding the use and security of personal data^[3]. This constitutes a core governance challenge in the digital transformation of public services.

© The Author(s) 2026

A. Y. M. A. Islam et al. (eds.), *Proceedings of the 2025 International Conference on Educational Technology and Management Information Systems (ETMIS 2025)*, Advances in Computer Science Research 129, https://doi.org/10.2991/978-94-6239-630-2_18

1.2 Theoretical Introduction

Scholars propose integrating public value theory with artificial intelligence to jointly construct a human-centered AI system (Valentin Wittmann et al., 2025)^[4]. They also formulate a normative hypothesis for government digitalization: digitalization holds the potential to enhance public value (Illugi Torfason Hjaltalin et al., 2024)^[5]. Digitalization facilitates information sharing and collaboration through digital technologies, thereby aiding digital transformation and public value creation (Joong-Yeup Lee, 2024)^[6]. However, amid the accelerated development of digital government, scholars also highlight concerns about digitalization's impact on citizen data privacy. For instance, open-source tools and artificial intelligence enable large-scale, low-cost analysis, but precise location data heightens privacy risks (Nathan Fox et al., 2025)^[7]. Furthermore, whether digital system users trust platforms depends on how authorities safeguard data privacy and security (Charu Sharma et al., 2025)^[8].

1.3 Innovative Aspects and Contributions of This Paper

This study adopts a citizen-centered approach, employing a questionnaire survey targeting Chinese netizens within the digital public service environment. It delves into the following core issues: citizens' overall attitudes toward large-scale data collection during public service digitization, specific concerns regarding personal data collection, and expectations for government measures to mitigate potential risks. Through systematic analysis and in-depth examination of these questions, the research aims to provide empirical evidence for subsequent proposals to optimize data collection in digital public services.

2 Literature Review

2.1 Digital Public Services Provide Citizens with Higher-quality Services

Digitalization of public services refers to the utilization of digital technologies to improve and enhance the delivery models, accessibility, efficiency, and quality of public services. This further promotes the equalization of basic public services and better meets the people's aspirations for a better life^[9]. Alexander Yuhno (2022) notes that big data technologies and software products can deliver services to citizens more efficiently while building a unified national digital ecosystem centered on big data^[10]. Xilu Chen et al. (2025) observe that public service digitization enables enterprises to access government-provided public services at lower costs^[11]. Lorena Espina-Romero (2025), through analyzing Peru's digital capabilities, demonstrates that digital transformation and e-government significantly impact national modernization^[12].

2.2 Digital Public Services Raise Citizens' Concerns About Personal Privacy

However, while digital government delivers efficient public services, citizens express concerns about potential privacy breaches during the collection of personal data

through big data. Citizen privacy concerns refer to the apprehensions and unease citizens feel regarding the possible illegal collection, use, disclosure, or misuse of their personal privacy information. Lisa Garbe et al. (2025) note that governments in the Global South have begun introducing biometric IDs to enhance national legibility, yet this raises significant questions about citizen privacy. Julieth Santamaria et al. (2025) observed that citizens' willingness to share personal data diminishes when data sharing is required but the destination of the data cannot be explained^[13]. Minjing Wang (2025) highlighted that data storage by media algorithms and the absence of privacy agreements and security measures on third-party platforms can lead to data misuse, potentially resulting in the leakage of users' personal data^[14].

2.3 Comment of Research Literature

Based on the above literature, this section will explore two aspects: the contributions of existing research and its limitations.

Contributions: Current positive research on public service digitization primarily focuses on two aspects. On one hand, numerous scholars argue that digitization significantly enhances public service efficiency through digital technologies, reduces government workload and costs, and contributes to greater budget transparency. On the other hand, existing studies have identified potential social risks during public service digitization, including widening the digital divide and triggering citizen concerns about privacy data.

Existing Shortcomings: Research on the conflict between public service digitization and citizen privacy still exhibits two deficiencies. First, existing studies neglect citizens' personal experiences and perceptions, failing to explore public concerns about services or expectations for governmental change. Second, research remains insufficient regarding specific governmental measures to mitigate potential risks. Therefore, this study adopts a citizen-centered perspective to investigate overall attitudes toward public service digitization and specific areas of concern.

3 Research Framework Design

The empirical framework of this study comprises two components: First, through large-scale surveys and interviews, we examine citizens' attitudes toward the collection of personal data in public service digitization, their specific concerns regarding privacy breaches, and their expectations for government improvements. Subsequently, we employ a multiple regression model analysis based on attitude functions and concern functions to explore citizens' actual attitudes and levels of concern toward public service digitization.

3.1 Questionnaire Design and Sample Analysis

To comprehensively understand citizens' attitudes toward and concerns about the digitization of public services, this study adheres to quantitative research principles and

employs a five-point Likert scale. The questionnaire design incorporates three dimensions: attitude, concern, and expectation. Each dimension includes three items, totaling nine items. See Table 1 for details.

Table 1. Questionnaire Structure Dimensions

<i>Dimension</i>	<i>Problem Instance</i>	<i>Purpose of Metric</i>
Attitude Dimension	I believe the digitization of public services can bring convenience to my daily life.	Citizens' Basic Attitudes Toward Personal Data Collection
Concern Dimension	I am concerned about the leakage of personal data during its collection and use by the government.	Citizens' concerns regarding the collection of personal data
Expectation Dimension	I believe the government needs to establish laws and regulations concerning the collection and use of personal data.	Citizens expect the government to improve its measures for collecting personal data.

Prior to formal distribution, this study analyzed the reliability and validity of the survey questions using SPSS software. The Cronbach's alpha coefficient was 0.743, and the KMO value was 0.811, indicating high reliability and validity of the questionnaire. During formal distribution, the questionnaire was disseminated through multiple channels including online survey systems and social media platforms, yielding a total of 515 responses. The collected questionnaires were screened according to established criteria, excluding those with unanswered questions or where the same response was selected for eight or more consecutive questions. Following this process, 500 valid questionnaires were ultimately obtained, interviews were conducted with a portion of citizens. The analysis of interview themes is shown in Table 2.

Table 2. Interview Topic Analysis

<i>Child Theme ID</i>	<i>Child Theme Name</i>	<i>Keyword Merging</i>
S1	Data collection and management lack transparency	Excessive collection, lack of informed consent, data security, data usage disclosure
S2	Ethical Risks in Data Application and Sharing	Algorithmic bias, privacy threats, third-party risks
S3	Absence of civil rights	Data subject rights, lack of voluntary authorization, digital dilemma

3.2 Modeling Attitude Functions and Concern Content Functions with Regression Variable Selection

This study introduces modeling approaches for the Simplified Attitude Function (CDSA) and the Simplified Concern Function (CDSC), providing a supportive framework for analyzing subsequent control experiment research data.

1) Attitude Function

The attitude function is modeled as follows:

$$Attitude_i = \beta_0 + \beta_1 DigitalU_{se_i} + \sum_k \beta_k X_{ik} + \varepsilon_i \tag{1}$$

Here, the use of digital public services is represented as a binary variable, where 1 indicates having used digital public services and 0 indicates not having used digital public services. $Attitude_i$ denotes the overall attitude score of citizens toward digital public services, X_{ik} represents the background control variables of citizens, β represents the regression coefficient, and ε represents the random error term. Variable settings are shown in Table 3:

Table 3. Attitude Function Regression Variable Setting Table

<i>Variable Name</i>	<i>Typology</i>	<i>Coding Instructions</i>	<i>Variable Roles</i>
Attitudes Toward the Digitalization of Public Services	continuous	Combined ratings	implicit variable
Digitalization of Public Services	binary variable	Digital used=1, not used=0	core independent variables
Age	categorical	18–45 years old=1, 45–50 years old and above=2	control variable
Region	categorical	Eastern Region=0, Central Region=1, Western Region=2	control variable
Concept of Digital Public Services	continuous	Understanding of the Digital Transformation of Public Services	control variable
Embracing the Digital Transformation of Public Services	continuous	Acceptance of Digital Public Services	control variable

2) Worry Function

The worry function is modeled as follows:

$$Worry_i = \beta_0 + \beta_1 DigitalU_{se_i} + \sum_k \beta_k X_{ik} + \varepsilon_i \tag{2}$$

Among these, citizens' concerns regarding privacy breaches, algorithmic bias, and unequal benefits in the digitalization of public services are examined. The usage of digital public services serves as the core explanatory variable, X_{ik} denotes background variables for citizens, β represents the regression coefficient, and ε signifies the random error term. Variable settings are shown in Table 4:

Table 4. Worry Function Regression Variable Setting Table

<i>Variable Name</i>	<i>Typology</i>	<i>Coding Instructions</i>	<i>Variable Roles</i>
Concerns Regarding the Digitalization of Public Services	continuous	Combined ratings	implicit variable

Digitalization of Public Services	binary variable	Digital used = 1, not used = 0	core independent variables
Age	categorical	18–45 years old=1, 45–50 years old and above=2	control variable
Region	categorical	Eastern Region=0, Central Region=1, Western Region=2	control variable
Concept of Digital Public Services	continuous	Understanding of the Digital Transformation of Public Services	control variable
Embracing the Digital Transformation of Public Services	continuous	Acceptance of Digital Public Services	control variable

This study aims to mitigate the impact of unit differences in dependent variables on the reliability of regression coefficients. Therefore, all scale variables were standardized. Modeling analysis was conducted using SPSS 27.0 software. After controlling for other factors such as gender, age, and region, citizens' usage of digital public services served as the core explanatory variable. Multiple linear regression analysis was employed to assess the independent effects of intervention variables. If the regression coefficient (β_1) for the core variable $DigitalU_{se}$ is significantly positive and the p-value is less than 0.05, it indicates that the usage behavior of digital public services statistically significantly enhances citizens' overall attitude toward digital public services. Concurrently, model fit is measured using R^2 and adjusted R^2 , while the overall robustness of the attitude function model is assessed through F-values and standardized regression coefficients.

4 Research Findings

4.1 Current Status of Digital Usage Analysis in Public Services

This chapter draws upon data from a large-scale survey of 203 respondents. Through systematic statistical analysis, it delves into citizens' perceptions of public service digitization, including their attitudes, concerns, and expectations for government-led changes.

Table 5. Three-Dimensional Quantitative Statistics on Citizens' Usage of Digital Public Services (n=203)

<i>Dimension</i>	<i>Measurement Items (Example)</i>	<i>Average</i>	<i>Standard deviation</i>
Attitude	I believe the digitization of public services can bring convenience to my daily life.	3.59	1.214
Attitude	I believe that the digital transformation of public services can enhance government efficiency and thereby deliver more services.	3.66	1.134

Attitude	I consent to the government collecting and using my personal data.	3.55	1.201
Concern	I am concerned about the leakage of personal data during its collection and use by the government.	3.52	1.183
Concern	I am concerned that the digital algorithms used by government departments may lack transparency or harbor biases, thereby undermining the fairness of public services.	3.61	1.066
Concern	I am concerned that refusing to allow the government to collect my personal data may affect my ability to access public services provided by the government in the future.	3.58	1.146
Expectation	I believe the government needs to establish laws and regulations concerning the collection and use of personal data.	3.49	1.168
Expectation	I hope the government will maintain traditional offline service channels while implementing digital public services.	3.63	1.165
Expectation	I believe the government should proactively and clearly disclose the scope, purpose, and protective measures for collecting personal data.	3.51	1.191

The survey results are shown in Table 5, indicating that citizens generally hold a positive attitude toward the digitization of public services. On the question “Do you believe that the digitization of public services can enhance government efficiency and thereby provide more services?”, citizens gave the highest average score of 3.66, demonstrating their positive stance toward the digitization of public services.

However, the standard deviation for the question “I can accept the government collecting and using my personal data” reached 1.201, reflecting a significant gap in citizens' acceptance of government collection of personal data. Citizens expressed strong expectations for improvements in the digitalization of public services. Most still hope to access offline services during the digitalization process, with an average score of 3.63 on this item, indicating that the current institutional framework for public service digitalization is not yet fully developed.

Citizens are increasingly concerned about their attitudes, worries, and expectations regarding personal data. The average score for “accepting government collection of personal data” was 3.55, while “concern about personal data leakage” scored 3.52. Additionally, “expecting the government to establish laws and regulations governing personal data collection” scored 3.49. The data indicates that citizens can accept the necessity of collecting personal data for public service digitization, but only with corresponding safeguards.

4.2 Application of Public Service Digitalization in Regression Verification Models

1) Attitude Function

Using an output function model, we examined the correlation between the digitalization of public services and citizens' attitudes toward it. The model was structured as follows: the independent variable was the application level of public service digitalization; the dependent variable was citizens' acceptance attitude toward public service digitalization; and the control variables included personal factors such as individual digital literacy and frequency of digital service platform usage. The final results are presented in Table 6.

Table 6. Regression Analysis Results on the Relationship Between Digital Public Services and Citizens' Attitudes and Concerns

<i>Variable</i>	<i>Regression coefficient β</i>	<i>Standard error</i>	<i>T-value</i>
Constant term (α)	62.47	1.38	45.26
Level of Digital Public Service Usage	7.92	1.67	4.74
Digital Skills Level	2.35	0.84	2.79
Technology Acceptance	4.18	1.02	4.10
Age	0.42	0.71	0.59
Occupational Type	0.76	1.12	0.68
Place of residence (urban=1, rural=0)	1.05	1.20	0.88

This chart presents a regression analysis examining the relationship between digital investment in public services, citizen attitudes, and their level of concern regarding potential risks, yielding the following conclusions:

Research Finding 1: A significant positive relationship exists between the level of public service digitization and citizen attitudes.

Research Finding 2: The coefficient of determination R^2 is 0.254, indicating that the attitude function model adequately explains variations in citizens' attitudes toward public service digitization.

Research Finding 3: Citizens' digital skill levels and their acceptance of technology significantly influence attitude evaluations.

Research Finding 4: Other factors such as individual digital literacy and usage frequency have no significant impact on citizens' attitudes toward public service digitization.

2) Worry Function

By employing an output function model, we examined the correlation between the digitalization of public services and citizens' perceived levels of concern regarding its potential risks. The model was structured as follows: the independent variable represented the application level of public service digitalization; the dependent variable measured citizens' perceived levels of concern about the potential risks of public service dig-

italization; and control variables included personal factors such as individual digital literacy and frequency of digital service platform usage. The final results are presented in Table 7.

Table 7. Regression Analysis Results on the Relationship Between Digital Public Services and Citizens' Perceived Risk Levels

<i>Variable</i>	<i>Regression co-efficient β</i>	<i>Standard error</i>	<i>T-value</i>
Constant term (α)	41.86	1.47	28.53
Level of Digital Public Service Usage	-5.14	1.58	-3.25
Digital Skills Level	-2.72	0.81	-3.36
Technology Acceptance	-3.95	0.97	-4.07
Age	0.63	0.69	0.91
Occupational Type	0.84	1.10	0.76
Place of residence (urban=1, rural=0)	1.28	1.16	1.10

This chart presents a regression analysis examining the relationship between digital investment in public services, citizen attitudes, and levels of concern regarding potential risks, yielding the following conclusions:

Research Conclusion 1: The application level of digital public services exhibits a significant negative correlation with citizens' perceived potential risks, meaning higher digitalization correlates with lower public concern about potential risks in public services.

Research Conclusion 2: The coefficient of determination R^2 is 0.231, indicating that the concern function model strongly explains variations in citizens' risk perceptions.

Research Finding 3: Citizens' digital skill levels and technology acceptance significantly mitigate risk concerns. Higher digital skills and stronger technology acceptance correlate with lower levels of concern regarding public service digitalization.

Research Finding 4: Other factors such as age, occupation type, and place of residence did not significantly influence citizens' levels of risk concern.

5 Discussion

5.1 Key Contributions of This Study and Recommendations for Future Research

The core premise of this study is that the tension between public service digitization and citizens' concerns about its potential risks manifests primarily at two levels: First, the attitude model aims to reveal citizens' attitudes toward public service digitization, while the concern model seeks to uncover the dialectical relationship between citizens' levels of concern about potential risks associated with public service digitization and the extent to which this relationship promotes such digitization. This constitutes the most significant value of this research, as the academic community has yet to conduct systematic studies on such issues. A limitation of this study is its narrow focus on Chinese citizens within the context of public service digitalization, which may affect the generalizability of its findings.

5.2 Strategic Recommendations

Based on the above research, this section proposes recommendations from a government perspective to alleviate public concerns and enhance the digitalization of public services: Establish stringent data protection laws, formulate clear and transparent data policies, and define the rights and responsibilities of government entities in using personal data, ensuring citizens' right to know about their data; Adopt privacy-preserving principles such as encryption and anonymization within public service digital systems to ensure citizens' technical ability to manage their own data; establish and continuously maintain accessible channels for citizen feedback and participation, empowering citizens with control over their personal data and transforming passive management into active citizen collaboration.

6 Conclusion

This study employed questionnaires and interviews to examine citizens' attitudes toward the digitization of public services and their concerns regarding its potential risks. A multiple regression model analysis based on attitude and concern functions was conducted to explore citizens' actual attitudes and levels of concern toward public service digitization. Statistical analysis of questionnaire and experimental data revealed that the level of public service digitization significantly influences citizens' attitudes and their degree of concern. However, the study also reveals that some citizens exhibit resistance toward the collection of personal data during the digitalization of public services. This resistance may lead to obstacles in advancing digital public services and erode public trust in government. Therefore, it is recommended that governments enhance the transparency and credibility of personal data collection, establish robust legal frameworks for digital public services, and improve citizens' digital literacy and trust in digital government. This research provides academic recommendations and data support for policymakers.

References

1. Yang, C., Gu, M., & Albitar, K. (2024). Government in the digital age: Exploring the impact of digital transformation on governmental efficiency. *Technological Forecasting and Social Change*, 208, 123722. doi: <https://doi.org/10.1016/j.techfore.2024.123722>
2. Guo, J., & Zhang, H. (2024). Digital age: The path choice of government-citizen value co-creation. *Heliyon*, 10(15), e35482. doi: <https://doi.org/10.1016/j.heliyon.2024.e35482>
3. Oomens, E. C., van Wegberg, R. S., van Eeten, M. J. G., & Klievink, A. J. (2025). Understanding public acceptance of data collection by intelligence services in the Netherlands: A factorial survey experiment. *Government Information Quarterly*, 42(4), 102077. doi: <https://doi.org/10.1016/j.giq.2025.102077>
4. Wittmann, V., & Meynhardt, T. (2025). Human-centric AI governance: what the EU public values, what it really, really values. *Government Information Quarterly*, 42(4), 102084. doi: <https://doi.org/10.1016/j.giq.2025.102084>

5. Hjaltalin, I. T., & Sigurdarson, H. T. (2024). The strategic use of AI in the public sector: A public values analysis of national AI strategies. *Government Information Quarterly*, 41(1), 101914. doi: <https://doi.org/10.1016/j.giq.2024.101914>
6. Lee, J., Kim, B., & Yoon, S. (2024). A conceptual digital policy framework via mixed-methods approach: Navigating public value for value-driven digital transformation. *Government Information Quarterly*, 41(3), 101961. doi: <https://doi.org/10.1016/j.giq.2024.101961>
7. Fox, N., Di Minin, E., Carter, N., Tomkins, S., & Van Berkel, D. (2025). Balancing accessibility and security: Safeguarding citizen-sourced biodiversity data in the age of AI and open-sourced software. *Ecological Informatics*, 92, 103443. doi: <https://doi.org/10.1016/j.ecoinf.2025.103443>
8. Sharma, C., Choudhary, S., & Mishra, S. S. (2025). Unfolding the relationship between data privacy and security, users' trust and satisfaction in smart cities using the IS model. *Transforming Government: People, Process and Policy*, 19(4), 775-794. doi: <https://doi.org/10.1108/TG-06-2025-0190>
9. Kang, J., Zhang, Q. Y., & Yang, S. (2025). Public Digital Burden Perception under the Digital Transformation of Public Services: Factual Characteristics and Generation Logic. *E-Government*, (07), 29-40. <https://doi.org/10.16582/j.cnki.dzzw.2024.07.003>.
10. Yukhno, A. (2024). Digital Transformation: Exploring big data Governance in Public Administration. *Public Organization Review*, 24(1), 335-349. doi: 10.1007/s11115-022-00694-x
11. Chen, X., Ge, E., Xu, X., & Zhou, Q. (2025). Does digitalization of government activities improve business environment? The influence of public service standardization. *Economic Analysis and Policy*, 87, 533-560. doi: <https://doi.org/10.1016/j.eap.2025.05.034>
12. Nose, M. (2023). Inclusive GovTech: Enhancing Efficiency and Equity Through Public Service Digitalization. *IMF Working Papers*, 2023(226), 1. doi: 10.5089/9798400258626.001
13. Santamaria, J., Roseth, B., & Aguirre, F. (2025). Does reluctance to share personal data reduce citizen demand for personalized services? Evidence from a survey experiment. *Journal of Behavioral and Experimental Economics*, 119, 102447. doi: <https://doi.org/10.1016/j.socec.2025.102447>
14. Wang, M. (2025). Media Algorithms and User Privacy Protection: a Dynamic Game of Conflict and Balance. *Procedia Computer Science*, 261, 605-611. doi: <https://doi.org/10.1016/j.procs.2025.04.251>

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

