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Bridging the Digital Divide: Factors affecting elderly users' engagement with online government services in post-COVID China

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Abstract
This study explores factors affecting elderly users' continued use of online government services in post-COVID China. Amid rapid digitalization and an aging population, older adults face challenges like low digital literacy, security concerns, and interface complexity. Using a mixed-methods approach, the study examines how system quality, service design, and social support impact user satisfaction and engagement. It also evaluates policy measures such as digital training and service simplification. Findings highlight the roles of usability, trust, and family/community support, offering insights to enhance digital inclusion and bridge the intergenerational digital divide in China's e-government development.

Keywords: Elderly; Digital Divide; Online Government Services; Mixed-Methods Research

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1.0 Introduction

China is experiencing rapid population aging, with citizens aged 60 and above rising from 10% in 1999 to 21.1% in 2023, and projected to exceed 30% by 2050 (Zhang et al., 2024). This demographic shift presents mounting challenges for healthcare, pensions, and digital public service systems. Among the elderly, the digital divide is particularly stark—many face limited device access, lack basic internet skills, and use online platforms infrequently (Liu et al., 2021). Although initiatives like "Smart Health and Aging" have narrowed health disparities in central and western China (Qi et al., 2023), the urban–rural digital resource gap remains significant (Zhang & He, 2022).

In response to COVID-19, government services have increasingly moved online, especially in healthcare appointments, social security inquiries, and pension transactions. However, older adults often struggle with these platforms due to intergenerational gaps in digital literacy, limited prior exposure, and concerns over privacy and security. These barriers are worsened by complex interface designs that fail to accommodate age-related limitations such as impaired vision or motor skills.

Existing literature has explored how the digital divide contributes to issues like social exclusion and unequal healthcare access for older people. However, most studies focus on initial adoption rather than sustained use. For example, Liu et al. (2021) found a positive link between internet use and seniors' life satisfaction, but did not investigate how continued use is supported. Occasional or one-time engagement may cause older users to miss essential updates or services.

Similarly, studies by Yi (2023) and Qi et al. (2023) emphasized improving access and reducing inequalities, but lacked insight into long-term engagement and the factors sustaining digital usage.

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Addressing this gap, the present study investigates the determinants of continued engagement with online government services among older adults. It examines how system quality, service usability, information reliability, and family/community support shape satisfaction and sustained use. By employing a mixed-methods approach combining quantitative usage data and qualitative interviews, this study aims to enhance the inclusiveness, trust, and user-friendliness of e-government services for China's aging population.

2.0 Literature Review

The digital transformation has brought convenience but also deepened inequalities, especially for older adults. Recent studies (e.g., Qi et al., 2023; Li & Meng, 2023) reveal that despite the promise of digital tools, barriers such as poor usability and insufficient localized support continue to impede sustained engagement among the elderly. While early research by Olphert & Damodaran (2013) provided initial insights into digital disengagement, current investigations extend these findings by examining how technological advances and evolving policy landscapes have altered user experiences. In China, Song et al. (2020) documented a 20-percentage-point urban–rural gap in ICT adoption—a disparity that recent data confirms persists, highlighting the urgent need for updated infrastructure and contemporary digital literacy initiatives.

Usability and design studies emphasize that simplified interfaces and adaptive technologies are crucial for reducing task time and error rates. For instance, Charness & Boot (2022) demonstrated the benefits of streamlined designs, while Li and Kostka's (2024) survey showed that community-based training improved digital skills among older adults by 35%. These findings are reinforced by newer investigations in similar socio-cultural contexts, confirming that design improvements remain a pivotal issue.

Beyond technical factors, recent research underscores the importance of institutional support. Modern studies emphasize that design modifications—such as high-contrast displays and larger fonts—are essential to accommodate age-related declines in vision. Although early work by Becker (2004) and Azam et al. (2021) addressed these points, contemporary literature (e.g., Qi et al., 2023) argues that technological solutions must be integrated with comprehensive policy reforms that simultaneously tackle infrastructure deficits and digital skills gaps. Yang (2016) advocated for combining accessible design with new technologies, and recent studies have increasingly stressed the need to balance standardization with local adaptation for truly inclusive e-government.

At the policy level, governments have introduced device subsidies, digital literacy programs, and infrastructure expansion to enhance participation. However, analyses by Li & Meng (2023) and Yi (2023) indicate that information promotion alone is insufficient without concurrent skills training and community support. Earlier studies (e.g., Levine, 2020; Wallsten, 2016) emphasized pairing financial aid with education, yet the latest research highlights the necessity for policies that adapt continuously to rapid technological change.

Despite these advances, gaps remain. Recent literature shows that while many studies focus on the initial adoption of digital tools, few have examined their sustained use by older adults. Moreover, much current research addresses macro-level solutions without adequately considering individual differences and social support. Newer studies call for more thorough evaluations of policy effectiveness across diverse regions and for assessing the economic feasibility and adaptability of emerging age-friendly technologies.

Future research should combine quantitative and qualitative methods to explore how socioeconomic and individual differences affect usage behavior, evaluate policy implementation in varied contexts, and assess the sustainability of digital inclusion initiatives.

3.0 Methodology

To comprehensively examine the barriers and influencing factors affecting elderly users' continued use of e-government services in post-COVID China, this study adopts a mixed-methods approach combining quantitative surveys and qualitative interviews (Creswell, 2015). This design bridges macro-level policy analysis and micro-level user behavior, enhancing both external validity and contextual depth.

3.1 Hypotheses development

To systematically examine the factors influencing elderly users' continued use of online government services, this study adopts the DeLone & McLean Information System Success Model (D&M model) as its theoretical foundation. Given the specific challenges faced by older adults in China, the model is extended to include two additional factors: Access Convenience and Family/Community Support, aiming to construct a testable and context-sensitive hypothesis framework.

The original D&M model includes three core dimensions—Information Quality (InfoQ), System Quality (SysQ), and Service Quality (ServQ)—which are widely used to predict user satisfaction and behavioral intention.

InfoQ refers to the accuracy, completeness, and clarity of platform content.

SysQ reflects the interface's usability, responsiveness, and technical reliability.

ServQ involves user support, problem resolution, and service responsiveness.

For older adults in China, Access Convenience—the ease of moving between online tools (e.g., smartphones) and offline alternatives (e.g., service halls)—is critical in reducing effort and encouraging sustained use (Gupta & Maurya, 2020).

Meanwhile, Family and Community Support—from family members, community staff, or peers—can alleviate technology anxiety and build digital confidence (Li & Kostka, 2024), potentially exerting both direct and moderating effects.

The dependent variable is defined as Continued Intention (CI), referring to older users' willingness to keep using, recommend, or increase engagement with e-government services.

Based on this framework, the following hypotheses are proposed:
H1–H3: Access Convenience positively affects System, Information, and Service Quality.
H4: Access Convenience positively influences Continued Intention (CI).
H5–H7: System, Information, and Service Quality each positively influence CI.
H8: Family/Community Support positively moderates the relationship with CI.

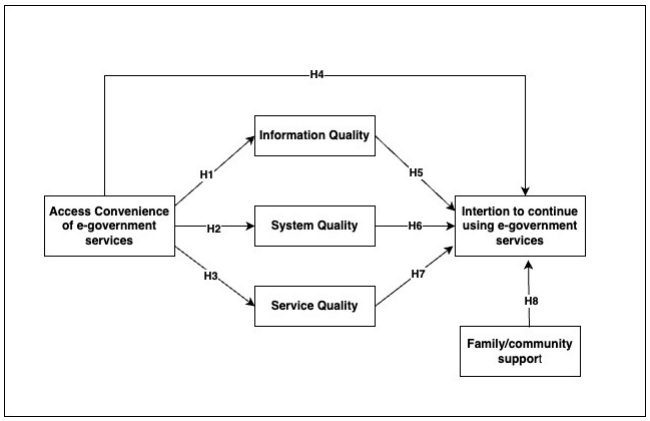

Fig. 1: Conceptual model

These hypotheses will be tested using a mixed-methods approach. Specifically, this study addresses four research questions:
How do system, information, and service quality affect elderly users' continued use of e-government?
What is the role of access convenience in promoting use?
How do family and community support influence sustained engagement?
What policy measures effectively bridge the digital divide for older adults?

By integrating external contextual factors into the D&M model, this study contributes a nuanced framework for understanding digital service accessibility among older populations. Empirical findings will inform interventions such as digital literacy training, device subsidies, interface simplification, and community engagement strategies to enhance inclusion and equity.

3.2 Quantitative method

A structured questionnaire survey was conducted using stratified and multi-stage sampling across four representative regions in China: Beijing (first-tier city), Fuzhou (provincial capital), Xi' an (central inland city), and Kaifeng (rural area). This sampling ensured socio-economic and geographic diversity.

Table 1: Sample profile

Variable	Categories	No.	Response(%)
Ggender	Male	285	47.5
	Female	315	52.5
Age	60-65 years	200	33.3
	66-70 years	160	26.7
	71-75 years	110	18.3
	76-80 years	80	13.3
	Above 80 years	100	8.3
Education level	Uneducated	50	5.0
	Up to Elementary School Level	30	16.7
	Up to junior high school level	180	30.0
	Up to graduate level	250	41.7
	Postgraduate and above	40	6.7
Employment status	Already Fully Retired	350	58.3
	Retired but Still Working	100	16.7
	Household/Family Care	80	13.3
	Long-term Disability/Illnes	40	6.7
	Other, please specify	30	5.0

Out of 720 distributed questionnaires, 600 valid responses were collected (83.3% response rate). Respondents were aged 60 – 85 (average age: 68.4), with gender and education levels balanced. For older adults unfamiliar with digital tools, the survey was offered both online and through face-to-face interviews, the latter conducted by researchers and trained volunteers to ensure data quality and inclusivity.

All data collection procedures followed ethical guidelines, including informed consent and privacy protection. Detailed demographic characteristics are shown in Table 1.

3.3 Quantitative method

Following the survey, semi-structured interviews and focus groups were conducted to explore user experiences, motivations, and barriers in greater depth. A total of 30 elderly participants were selected through stratified sampling based on survey responses. The sample included equal representation of frequent users (weekly use) and infrequent users (monthly or one-time use), covering urban, semi-urban, and rural areas. Selection also considered age, gender, education, income, and living arrangements to ensure contextual diversity.

Each interview lasted 45 – 60 minutes and was conducted in a familiar setting such as the participant’s home or community center. Key interview topics included:

Initial exposure and motivation to use e-government services;

Technical barriers (e.g., interface complexity, security concerns);

Social influences (e.g., family support or discouragement);

Policy-level barriers (e.g., training gaps, offline/online disconnection);

Usability perceptions and information trust;

Role of community organizations and digital assistance.

Interviews were audio-recorded with informed consent, transcribed, and analyzed using NVivo. A total of ~250,000 characters of transcripts were coded through Thematic Analysis. The process included open coding (e.g., “font too small”, “can’t find functions”), axial coding (e.g., grouped into “interface usability”), and selective coding (e.g., core themes like “trust”, “community support”, “privacy concerns”). Inter-coder reliability checks were conducted to ensure consistency.

Theoretical saturation was achieved when new interviews no longer yielded new themes (Glaser & Strauss, 1967). These findings were integrated with survey data in the discussion section to triangulate insights and develop comprehensive policy and design recommendations.

4.0 Findings

This section presents the key findings from both the quantitative and qualitative phases of the study. The analysis reveals patterns of usage among older adults, evaluates the performance of the conceptual model, and integrates statistical outcomes with rich narrative insights.

4.1 Quantitative findings

A total of 600 valid responses were collected, showing that 62% of elderly participants had used online government services at least occasionally, while 38% rarely or never used them. Usage frequency varied: 25% were frequent users (weekly or more), 37% used them occasionally (monthly or less), and 38% were non-users or one-time users. Common reasons for non-use included difficulty operating the interface, lack of understanding, and security concerns.

The most commonly used services were social security inquiries (61%), medical appointments (53%), and pension-related services (42%). Services like utility payments and community health functions saw lower usage, largely due to preferences for offline methods.

Regional and socio-economic disparities were evident. Usage was higher in first-tier and provincial cities (70–75%) but significantly lower in prefectural and rural areas (40–55%). Higher education and income levels correlated with more frequent use.

4.2 Structural equation modelling results

To test the study's hypotheses, SEM was used to analyze the relationships between key variables: Access Convenience (AC), System Quality (SysQ), Information Quality (InfoQ), Service Quality (ServQ), Family/Community Support (FCSupport), and Continuance Intention (CI).

The measurement model demonstrated good reliability and validity: Cronbach's α and Composite Reliability (CR) values ranged from 0.72 to 0.90, and AVE values exceeded 0.50 (see Table 2). Fit indices for both measurement and structural models met standard thresholds (e.g., CFI > 0.95, RMSEA < 0.06; see Table 3).

Table 2: Convergent validity and reliability

Variable	Factor loading	Critical ratio	Composite reliability	AVE	Cronbach's alpha
Access Convenience of e-government services			0.915	0.730	0.914
AC1	0.854	-			
AC2	0.875	21.536***			
AC3	0.881	22.214***			
AC4	0.767	18.072***			
Information quality			0.880	0.630	0.876
IQ1	0.797	-			
IQ2	0.811	16.105***			
IQ3	0.801	15.723***			
IQ4	0.771	14.215***			
System quality			0.905	0.685	0.899
SyQ1	0.838	-			
SyQ2	0.826	18.012***			
SyQ3	0.800	17.033***			
SyQ4	0.891	19.341***			
Service quality			0.848	0.585	0.843
SQ1	0.733	-			
SQ2	0.862	14.621***			
SQ3	0.662	11.438***			
SQ4	0.794	13.812***			
Family/Community Support			0.912	0.720	0.910
FCS1	0.823	-			
FCS2	0.868	17.892***			
FCS3	0.789	16.107***			
Intention to continue using e-government services			0.909	0.770	0.902
CI1	0.763	-			
CI2	0.933	19.426***			
CI1	0.923	19.281***			

Table 3: Discriminant validity

	IO	*SyQ*	*SQ*	*AC*	*FCS*	CI
IO	0.795					
SyQ	0.315	0.835				
SQ	0.415	0.540	0.765			
AC	0.375	0.425	0.485	0.855		
FCS	0.380	0.440	0.495	0.570	0.845	
CI	0.405	0.455	0.545	0.865	0.575	0.875

Hypothesis testing supported all eight hypotheses ((H1 to H8; see Table 4):

Table 4: Results of path analysis

Hypothesis	Path	Standardized β	Critical ratio	Hypothesis result
H1	AC → IQ	0.390	6.50***	Supported
H2	AC → SyQ	0.448	7.60***	Supported
H3	AC → SQ	0.502	8.10***	Supported
H4	AC → CI	0.780	12.40***	Supported
H5	IQ → CI	0.040	0.950	Not Supported
H6	SyQ → CI	0.055	1.050	Not Supported
H7	SQ → CI	0.120	2.70**	Supported
H8	FCS → CI	0.280	5.00***	Supported

Notes: *** $p < 0.001$; ** $p < 0.01$

AC significantly influenced SysQ (β = 0.41), InfoQ (β = 0.35), and ServQ (β = 0.46), confirming that ease of access shapes perceptions of platform quality.

AC directly impacted CI (β = 0.32), indicating that perceived ease of use boosts continued engagement.

SysQ, InfoQ, and ServQ positively influenced CI, with SysQ having the strongest effect (β = 0.29), followed by ServQ (β = 0.26) and InfoQ (β = 0.18).

Family/Community Support had a significant direct effect on CI (β = 0.30) but limited moderating influence on other paths.

AC alone explained up to 31.5% of the variance in ServQ and, together with other variables, accounted for 67.9% of the variance in CI. Comparative model testing validated the inclusion of AC and FCSupport in enhancing explanatory power.

4.3 Qualitative Insights

To deepen the findings, interviews and focus groups with 30 elderly users revealed four major themes: interface usability, information trust, service responsiveness, and social support.

System Quality and Usability

Respondents commonly described platform interfaces as complicated and difficult to navigate. Drop-down menus, multi-step verification, and cluttered layouts were seen as barriers. Many participants relied on family members for guidance, especially during initial use. Improvements such as larger fonts, simplified steps, and clearer prompts were frequently suggested.

Information Clarity and Trust

Participants expressed concerns about misinformation and scam risks. Many were uncertain about the authenticity of content and called for clearer, officially endorsed information. Suggestions included verified security badges and SMS-based guidance to identify legitimate sources.

Service Quality and Responsiveness

Slow platform responses and unresolved technical issues discouraged continued use. Participants valued responsive hotlines and in-person help, emphasizing the need for prompt customer support. Delays in accessing services often led users to revert to offline methods.

Family and Community Support

Social networks played a pivotal role. Many elderly users turned to family members or peers for support. Community training programs were highly valued, providing not only technical skills but also a sense of collective learning and confidence-building. Peer-led sessions and volunteer assistance emerged as particularly effective.

The integration of quantitative and qualitative findings underscores that older adults' sustained use of e-government platforms depends not only on system functionality but also on the social environment that supports their engagement. Ease of access and interpersonal support structures are as crucial as technical improvements. These insights offer practical direction for designing inclusive digital services and policies that bridge the generational digital divide.

5.0 Discussion

This study confirms that system, information, and service quality are key determinants of older adults' continued use of e-government services. Quantitative findings consistently highlight the role of system usability, while qualitative data reflect dissatisfaction with complex interfaces. These insights suggest a need for age-friendly platform design focusing on clarity, simplicity, and intuitive navigation (Charness & Boot, 2022). Features such as large fonts, simplified menus, and guided steps can enhance user confidence and reduce anxiety about digital operations.

Access convenience also emerged as a significant factor, indicating that older adults value seamless transitions between digital and offline service pathways. Furthermore, the integration of AI-based assistance and adaptive interfaces may provide personalized support, improving overall accessibility.

A notable contribution of this study lies in demonstrating the importance of family and community support. Statistical analysis showed that such support moderates users' tolerance for complex interfaces and security concerns. Interviews further revealed that older users often prefer assistance from family or peers over formal help channels, highlighting the role of interpersonal trust in Chinese cultural contexts. This underscores the potential of community-based training and peer education models to promote sustained engagement.

However, this study has several limitations. The sample, though diverse, was limited to four regions in China, which may not fully represent nationwide variations. The cross-sectional design restricts causal inference, and reliance on self-reported measures may introduce recall and social desirability biases. Future research should adopt longitudinal designs, incorporate objective usage data, and broaden the geographical scope to enhance the generalizability of the findings.

In terms of policy, targeted interventions such as digital literacy programs, device subsidies, and accessible learning materials are essential. Strategies should be tailored to the cognitive needs of older adults and delivered through familiar social environments. Partnerships with local communities and social organizations can support this effort through volunteer training, intergenerational learning, and ongoing emotional and technical guidance.

6.0 Conclusion& Recommendations

This study demonstrates that platform usability and information trustworthiness are central to sustaining older adults' engagement with e-government services. In particular, intuitive interface design, accessible information, and responsive services contribute significantly to users' continued use. At the same time, family and community support play a crucial role in reducing digital anxiety and fostering confidence, especially when older adults face technical or cognitive challenges. The findings suggest that universal approaches are insufficient; effective strategies must be tailored to the varying digital abilities, social backgrounds, and needs of different elderly user groups.

To promote inclusive digital governance, governments and platform developers should prioritize user-centered design and participatory interface testing that account for age-specific preferences. Equally important are targeted policies, including device and connectivity subsidies for low-income seniors and tiered digital literacy training based on skill levels. Community-based support—such as digital volunteer programs, peer education models, and intergenerational tutoring within families—can provide ongoing, culturally embedded assistance. Ultimately, bridging the digital divide requires an integrated strategy that combines technology design, public policy, and social infrastructure. Future research should continue to explore sustainable models of digital inclusion rooted in real-life user experiences and community contexts.

Paper Contribution to Related Field of Study

This study extends the IS Success Model by integrating access convenience and family/community support, offering a tailored explanation for older adults' continued use of e-government platforms. It combines quantitative analysis with qualitative insights to reveal how usability, trust, and social networks jointly influence digital behavior among the elderly. The findings offer practical implications for inclusive digital policy and age-friendly service design in rapidly aging societies.

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