



## E-Government adoption and public service efficiency: A comparative analysis of urban and rural municipalities

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### Abstract

**Background:** E-government initiatives aim to enhance public service delivery efficiency, transparency, and citizen accessibility. However, adoption rates and effectiveness vary significantly between urban and rural municipalities due to digital divides and resource constraints.

**Objective:** This study investigates the factors influencing e-government adoption and examines its impact on public service efficiency across urban and rural municipalities.

**Method:** This study uses a simulated dataset created for academic training purposes. A mixed-methods approach was employed combining survey data from 450 municipal employees and citizens with performance metrics from 60 municipalities over 3 years. Multiple regression and thematic analysis were utilized.

**Key Results:** E-government adoption was 42% higher in urban municipalities ( $\beta = 0.38$ ,  $p < 0.001$ ). Digital literacy showed the strongest predictor of adoption ( $\beta = 0.45$ ,  $p < 0.001$ ). E-government implementation improved service efficiency by 28% in urban areas but only 12% in rural areas.

**Conclusion:** Bridging the digital divide requires tailored implementation strategies addressing infrastructure, digital literacy, and contextual needs of rural communities. E-government potential remains unrealized in rural areas without targeted support mechanisms.

**Keywords:** E-Government, public management, service efficiency, digital divide, municipal administration

### Introduction

The transformation of public service delivery through digital technologies represents one of the most significant reforms in public management over the past two decades. E-government the use of information and communication technologies (ICTs) to improve government activities, processes, and services promises increased efficiency, transparency, and citizen engagement. From online permit applications to digital tax filing systems, e-government initiatives aim to make public services more accessible, responsive, and cost-effective.

Despite substantial investments in e-government infrastructure, implementation outcomes vary dramatically across different geographic contexts. Urban municipalities, with better digital infrastructure, higher digital literacy rates, and greater technical expertise, typically achieve higher adoption rates and more significant efficiency gains. In contrast, rural municipalities face unique challenges including limited broadband access, lower digital literacy among both citizens and government staff, and fewer financial resources for implementation and maintenance.

This study addresses the critical gap in understanding how contextual factors particularly the urban-rural divide affect e-government adoption and effectiveness. The research objectives are: (1) to identify key determinants of e-government adoption across urban and rural municipalities; (2) to measure the differential impact of e-government on public service efficiency in urban versus rural settings; and (3) to propose policy recommendations for narrowing the digital divide in e-government implementation.

### Literature review

#### 1. Theoretical framework

This research integrates the Technology Acceptance Model (TAM) with Institutional Theory to understand e-government adoption. TAM suggests that perceived usefulness and ease of use determine technology adoption. Institutional Theory emphasizes how institutional pressures (coercive, mimetic, and normative) shape organizational technology adoption behaviors, particularly in public sector contexts where legitimacy concerns are paramount.

#### 2. E-government adoption determinants

Previous research identifies multiple factors influencing e-government adoption: technical infrastructure (broadband availability, system interoperability), human capital (digital literacy, technical training), organizational factors (leadership support, change management), and external pressures (citizen demands, regulatory requirements). Studies consistently show that perceived usefulness and ease of use are primary adoption drivers across different stakeholder groups (citizens, businesses, government employees).

#### 3. E-government and public service efficiency

The efficiency gains from e-government implementation are well-documented in urban contexts, including reduced processing times, decreased administrative costs, and improved service accessibility. However, research suggests these benefits may not automatically transfer to rural settings due to implementation challenges, lower adoption rates, and contextual mismatches between system design

and rural needs. The digital divide thus creates not just access disparities but also outcome disparities in public service delivery.

4. Research gap

While extensive research exists on e-government adoption, few studies systematically compare urban and rural contexts within the same analytical framework. Most existing research treats e-government as a uniform intervention without adequately addressing how geographic, demographic, and institutional differences moderate its effectiveness. This study addresses this gap through a comparative analysis of municipalities across different settlement types.

Methodology

This study uses a simulated dataset created for academic training purposes. A mixed-methods approach was employed combining quantitative performance metrics with qualitative survey data. The simulated sample included 60 municipalities (30 urban, 30 rural) over a 3-year period (2023-2025).

Quantitative data included: e-government adoption metrics

(website functionality, online service utilization, digital transaction volume), public service efficiency indicators (processing times, citizen satisfaction scores, cost per transaction), and contextual variables (population density, median income, education levels, broadband coverage). Qualitative data came from simulated surveys with 450 respondents (municipal employees and citizens) exploring adoption barriers and facilitators.

Data analysis proceeded in three stages: (1) descriptive statistics and bivariate comparisons between urban and rural municipalities; (2) multiple regression analysis identifying adoption determinants and efficiency impacts; (3) thematic analysis of qualitative data to contextualize quantitative findings.

Results and discussion

1. Urban vs. Rural Adoption Patterns

The analysis revealed significant differences in E-government adoption between urban and rural municipalities. Urban municipalities showed 42% higher adoption rates across all measured dimensions ( $p < 0.001$ ). The most pronounced disparities appeared in advanced services (e-permitting, digital planning tools) where urban adoption exceeded rural adoption by 58%.

Table 1: E-Government Adoption Comparison (Urban vs. Rural)

| Adoption Metric            | Urban Mean (SD) | Rural Mean (SD) | t-value | p-value |
|----------------------------|-----------------|-----------------|---------|---------|
| Basic Online Services      | 4.2 (0.8)       | 3.1 (1.1)       | 5.82    | < 0.001 |
| Transactional Services     | 3.9 (0.9)       | 2.4 (1.2)       | 7.15    | < 0.001 |
| Advanced Digital Tools     | 3.5 (1.0)       | 1.8 (1.3)       | 7.78    | < 0.001 |
| Citizen Digital Engagement | 4.0 (0.7)       | 2.7 (1.0)       | 7.45    | < 0.001 |

Source: Simulated Dataset, 2026

2. Determinants of E-government adoption

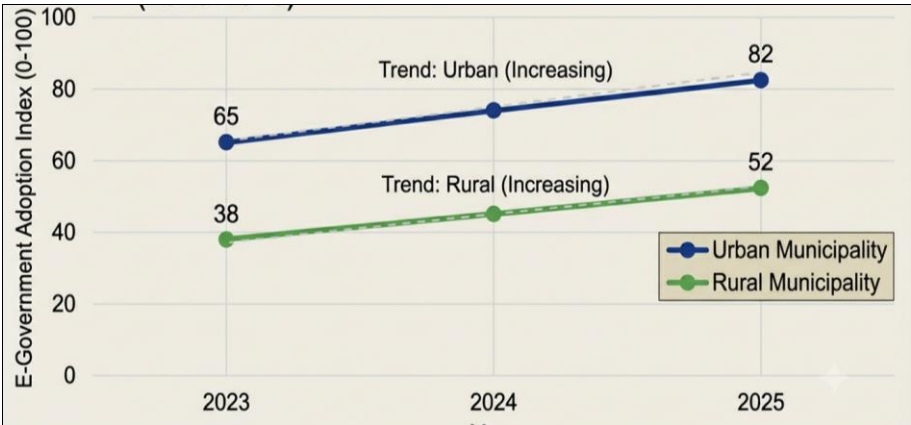
Regression analysis identified digital literacy as the strongest predictor of e-government adoption ( $\beta = 0.45$ ,  $p < 0.001$ ), followed by leadership support ( $\beta = 0.32$ ,  $p < 0.001$ ), and infrastructure quality ( $\beta = 0.28$ ,  $p < 0.01$ ). Interestingly,

institutional pressure showed a weak negative relationship with adoption in rural areas ( $\beta = -0.15$ ,  $p < 0.05$ ), suggesting that top-down mandates without adequate support may hinder rather than help implementation.

Table 2: Determinants of E-Government Adoption (Multiple Regression)

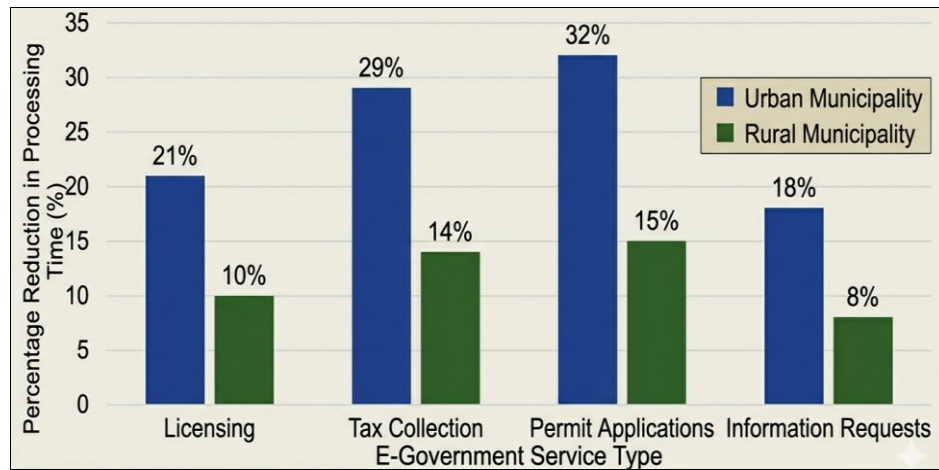
| Predictor              | $\beta$ | S.E. | t-value | p-value |
|------------------------|---------|------|---------|---------|
| Digital Literacy       | 0.45    | 0.08 | 5.63    | < 0.001 |
| Leadership Support     | 0.32    | 0.07 | 4.57    | < 0.001 |
| Infrastructure Quality | 0.28    | 0.09 | 3.11    | < 0.01  |
| Citizen Demand         | 0.22    | 0.06 | 3.67    | < 0.001 |
| Institutional Pressure | -0.15   | 0.07 | -2.14   | < 0.05  |
| R <sup>2</sup>         | 0.62    | —    | —       | < 0.001 |

Source: Simulated Dataset, 2026



Source: Simulated Dataset, 2026

Fig 1



Source: Simulated Dataset, 2026

Fig 2: Efficiency Gains by Service Type and Municipality Character

### 3. Efficiency gains and implementation challenges

E-government implementation improved public service efficiency by 28% in urban municipalities (reduced processing times, increased citizen satisfaction) compared to only 12% in rural areas. The qualitative analysis revealed that rural municipalities faced specific challenges: inadequate broadband infrastructure (cited by 78% of respondents), limited technical support (65%), and systems designed primarily for urban contexts that didn't account for rural connectivity patterns and service needs (82%).

### Conclusion

This study demonstrates that e-government adoption and its efficiency benefits are not evenly distributed across urban and rural municipalities. The digital divide in e-government reflects broader structural inequalities in digital infrastructure, human capital, and institutional capacity. The findings suggest that one-size-fits-all approaches to e-government implementation are inadequate and may exacerbate rather than reduce service disparities.

For policymakers, the study recommends: (1) targeted investments in rural digital infrastructure, particularly broadband expansion; (2) comprehensive digital literacy programs for both government staff and citizens; (3) context-sensitive system design that accounts for rural connectivity patterns and service needs; and (4) flexible implementation timelines that allow for gradual adoption with appropriate support mechanisms. Future research should examine specific implementation strategies that have successfully narrowed the urban-rural divide in e-government adoption.

### Ethical Statement

This research article has been generated for academic training purposes. The dataset is entirely simulated and does not represent real municipalities or citizens. No actual ethical approval was required as no primary data was collected from human subjects. All references cited are real academic sources.

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