

NATIONAL RESEARCH UNIVERSITY HIGHER SCHOOL OF ECONOMICS

P U B L I C ADMINISTRATION I S S U E S

Research and Educational Journal
Published since 2007

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The PUBLIC ADMINISTRATION ISSUES journal has been published at the National Research University Higher School of Economics (HSE) in Moscow, Russian Federation since 2007.

The mission of the journal is to create a modern platform of full value for discussion, exchange of international and national experience and specific knowledge among professionals in the field of Public Administration; for working out and further correcting the development strategy of public and municipal administration.

The editorial policy is to provide a very clear emphasis on the specific subject along with a focus on the interconnection of the proper public administration problems with the relative economic, legal, political science and managerial problems, including the interaction of the state and civil society.

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GUEST EDITOR'S FOREWORD

Data-driven governance is currently, obviously, a leading trend in all countries and regions of the world. Attitudes toward the use of data in the preparation and implementation of management decisions vary, including mistrust of data, questioning its validity, focusing on the high cost of collecting and processing data, criticizing executive managers for «working to metrics,» and accusing the bodies that set metrics and monitor their implementation of a formal, oversight-based approach to performance, and so on. However, the rapid growth of data-driven governance practices suggests that the truth lies somewhere in the middle, and neither a resolute rejection of its usefulness, nor unconditional support for this management style are the right options. Various circumstances and methods for data implementation in governance are possible. Therefore, governance practice dictates the need for studying data-driven governance in its various manifestations, across different countries and governance sectors.

The task of data-driven governance analytics is complicated by the existence of various theoretical approaches, which collectively constitute the emerging paradigm of data-driven governance, also known as the «data-dependent governance» paradigm. For example, data-centric governance assumes that decisions are made solely on the basis of data and the results of its processing; AI governance focuses on the involvement of specialized large-scale language models in decision development; the indicative approach suggests relying on benchmarks based on pre-established indicators and performance criteria; and evidence-based policy relies on statistically valid evaluation of proposed solutions within controlled settings, alongside strict adherence to protocols during both decision making and implementation phases. This list could be continued, but it is clear that, theoretically, data-driven governance research can and should recognize the existence of various theoretical approaches to data-driven governance.

The rapidly developing BRICS+ countries and countries of Global South, which have long followed in the wake of developed countries' governance practices and theories, are actively embracing data-driven governance and making significant contributions to understanding its potential and limitations. This contribution is further reflected in the growing volume of articles submitted to «Public Administration Issues» that examine data-driven governance in rapidly developing countries and regions. This scholarly focus has demonstrated a consistent upward trend, with related articles now comprising the majority of the present issue.

The section devoted to data driving management opens with the article «*Smart Governance Through Mobile Applications: A Cross-City Assessment of Citizen-Centric Digital Platforms in India's Smart Cities*», dedicated to the implementation of India's national Smart Cities Mission program, adopted in 2015. The importance of data-driven urban governance in the BRICS+ countries is underscored by the plan to hold the conference «Cities at the Frontiers: Urban Governance, Development, and Transformation in the BRICS+ and the Global South» (University of Pretoria, South Africa) in April 2027. The use of mobile applications for e-governance can, in principle, solve several problems simultaneously: simplifying interactions with citizens through mo-

mobile apps on their smartphones, reducing paperwork, and enhancing transparency and accountability. However, the success of this tool cannot be considered absolute. Using materials from Smart Governance Mobile Applications in 100 Smart Cities across India, the authors demonstrate that the situation with mobile app adoption varies significantly across cities along multiple dimensions (the presence of various and not always fully functional mobile governance platforms, platform accessibility issues, different levels of multipurpose served by the mobile governance platforms, etc.). Higher app adoption correlates with metropolitan size, local institutional capacity, multilingual interface availability, and digital literacy abilities of the citizens.

The role of AI chatbots in enhancing digital governance efficiency in developing countries is analyzed in the article «*Assessing the Important Factors of AI Technology for Proving the Efficiency of Digital Governance: A Case Study of AI Chatbots in Public Administration Services*». Using Uzbekistan as an example, the article examines the use of AI chatbots in administrative services. The use of such chatbots enhances the digitalization of public services, making them more responsive and personalized. However, by applying the Technology Acceptance Model (TAM) to empirical data, the authors construct a more context-sensitive understanding of chatbot deployment in administrative services, demonstrating how adoption patterns are shaped by agency-specific characteristics and organizational realities. The findings suggest that the mere use of chatbots does not necessarily indicate trust in them as tools that facilitate the provision of administrative services to citizens. If citizens perceive a government agency as ineffective and not transparent, if the agency lacks leadership focused on digitalization and the use of artificial intelligence, if the agency lacks a strategy for developing tools for using AI in services, if there is no ethical regulation of chatbots, and if there is no effective data management, then trust in agency chatbots will be low.

The article «*Revisiting the Role of Satisfaction in E-Government Loyalty: Evidence from a Digital Transportation Platform in Indonesia*» continues exploring trust in digital services. Having examined government-operated digital transportation platforms, the authors show that usefulness and system quality have a great impact on both citizen satisfaction and citizen loyalty. Notably, the findings reveal a divergent pattern: digital service quality significantly impacts satisfaction but not loyalty, whereas digital trust significantly drives loyalty without affecting satisfaction. Furthermore, while satisfaction directly influences loyalty, it does not mediate the effects of any exogenous constructs on loyalty. This nuanced differentiation among trust, satisfaction, and loyalty enriches our understanding of digital service perception, thereby enabling more targeted and effective service design.

Finally, the data-driven governance section concludes with the article «*A Governance Sustainability Trajectories: Insights from China*». The author asks whether AI policy measures are sufficient to ensure the sustainability of the public governance system. In other words, can AI governance be fully relied upon, or are meaningful adjustments inevitable? The author examines national and international AI governance development strategies and demonstrates that these strategies must consider the requirements of governance system sustainability, the capacity of AI governance arrangements to remain institutionally resilient, administratively viable, and accountable – preserving over time while adapting to technological change. The term «sustainability by integration» is introduced, emphasizing the incorporation of sustainability considerations into the design,

implementation, and oversight of AI governance arrangements. An integrated governance approach incorporates the socioeconomic aspects of AI governance application, as well as the ethical and algorithmic requirements for such application. Thus, without incorporating AI governance into sustainable management, AI governance will be ineffective.

This issue of the journal also features articles on other topics relevant to rapidly developing countries: Accountability and Corruption, Innovation, and Bureaucracy.

The article «*Changing Trends in Citizens' Perception of Local Government Accountability in Vietnam: An Analysis of Papi Data, 2011–2024*» explores the national trajectory of perceived accountability, regional disparities, and the roles of transparency and citizen participation in shaping accountability outcomes. The trajectory shows improvement between 2011 and 2014, a decline from 2015 to 2018, and stabilization at lower levels after 2019. Transparency emerges as the strongest predictor of perceived accountability among the factors examined, while citizen participation contributes modestly unless supported by open information channels. The article «*Supplier Selection and Municipal Corruption in Peru*» further continues the thematic focus on Accountability and Corruption. This article examines two types of anti-corruption measures – institutional prevention and control and sanctions (based on results) – as they relate to supplier selection for municipal procurement. Using survey data from the city in Peru (San Ignacio) as an example, it demonstrates the crucial role of ethical, accountability, and transparency factors in such selection, which contributes to mitigating corruption risks and enhancing the city's economic sustainability.

Innovative governance is thematically represented in the issue by the article «*Public Policy Frameworks for Promoting Green Innovation: Implications for the Performance of a Firm*». Based on a statistical analysis of over 300 companies from various sectors of the Pakistani economy, the article demonstrates that strong public policy supporting green innovation leads to a boost in firm performance. Green innovation initiatives seem to bring greater advantages to large firms and manufacturing companies compared to small businesses and others. These findings demonstrate that adaptability to innovation is uneven, and small businesses need additional support in their transition to innovation.

The issue of the journal concludes with the article «*The Politics-Bureaucratic Interface in the Recruitment, Promotion, and Training of Civil Servants in Amhara National Regional State, Ethiopia*». The topics of personnel selection, development, and professional development in the civil service are constantly under the scrutiny of researchers in rapidly developing countries. The clash of two approaches to personnel practices – merit-based and politically influenced – is ambivalent, as demonstrated by the example of one province in Ethiopia: promotion and training are more influenced by political reasons, while recruitment is more merit-driven, despite occasional inconsistencies, weak personnel management systems, and ineffective assessment procedures.

The geographic breadth of this issue is impressive: it features authors from China, Ethiopia, India, Indonesia, Peru, the Republic of Korea, Uzbekistan, and Vietnam. It can be said that researchers from many BRICS+ countries and the Global South are actively participating in the development of Public Administration theory and practice in its key areas.

Guest Editor,
Alexey G. Barabashev

Original article

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SMART GOVERNANCE THROUGH MOBILE APPLICATIONS: A CROSS-CITY ASSESSMENT OF CITIZEN-CENTRIC DIGITAL PLATFORMS IN INDIA'S SMART CITIES

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Abstract. The recent and increasing digitalisation of India's governance framework represents a significant change in its urban development. The Smart Cities Mission is the response to the pressures of urbanisation by transitioning from traditional paper-based legacy models to agile, citizen-centric digital set-ups. This study provides a national-level assessment of how mobile governance platforms are transforming public service delivery and institutional processes across India's 100 Smart cities. Using secondary datasets drawn from official portals, municipal dashboards, app-store metadata, and the Smart Cities Mission Data Portal, the research evaluates variations in service maturity, accessibility, citizen engagement, and inclusiveness. Anchored in the smart governance and citizen-focused governance frameworks, the analysis shows that cities such as Indore, Bhubaneswar, Pune, and Chennai have developed more advanced, integrated and participatory digital ecosystems, whereas several northern and Tier-2/Tier-3 cities continue to face challenges related to accessibility, multilingual support, and infrastructural limitations. The study argues that the long-term effectiveness of smart governance depends on interoperability, equity-oriented design, strong institutional coordination, and integration with national digital infrastructures. The findings contribute to the broader discourse on digital transformation by offering empirically grounded insights into the governance, technological, and social dimensions shaping citizen-centric innovation in India.

Keywords: smart governance; mobile governance; citizen-centric governance; Smart cities; digital transformation.

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Introduction

India’s digital adoption over recent years has acted as a technology-driven paradigm for administrative reforms, integrating services through several technological platforms – and this has resonated with the emergence of Smart governance. The Smart Cities Mission (SCM), announced in 2015 by the Government of India, became the flagship programme that helped to reimagine urban governance across the country¹. The introduction of mobile apps for e-governance emerged as a strategic tool for government to approach and interact with citizens directly on their smartphones, to simplify public service access, provision of those services, and promote greater levels of transparency and accountability (Das, 2024). The Smart Cities Mission occurred as India’s way of responding to the pressures of urbanisation by transitioning from traditional paper-based legacy models to agile, citizen-centric digital set-ups. The primary objectives of Smart governance can be classified into four categories: area-based retrofitting, urban renewal projects, housing policies for affordable homes, and pan-city proposals that incorporate smart initiatives focusing on technology interventions such as information and communication technology (ICT) (Parida, 2021).

At the heart of these efforts is the necessity for citizen-centrism i.e., technology is not only to digitise the administration’s workflow but must also tangibly improve the lived experience of urban residents (especially those who had previously been marginalised by bureaucratic barriers). Mobile apps have been transforming e-governance in India by providing channels of connectivity between government and citizens, forming pivotal technical infrastructure to realise the aspirations of ‘Digital India’, the corresponding national goal launched together with SCM with goals such as abolishment of unemployment, widespread governance service delivery, and urban empowerment (Meitei, 2025). The MyGov, UMANG and Digi Locker are primary examples of digital services, as they bundle vital public services together with addressing complaints, issuing certificates, and utilities payments – all on user-friendly multi-language app interfaces twenty-four hours a day, seven days a week (IBEF, 2024). Among these three examples, the UMANG app (Unified Mobile Application for New-age Governance) has gained more prominence, downloaded over 30 million times, which acts as a clear indication of steep growth in smart governance adoption rates in past few years². India’s digital urban governance model has

¹ Ministry of Housing and Urban Affairs. (2025). Documents. Smart Cities Mission Data Portal. URL: <https://smartcities.data.gov.in/document>

² UMANG App. Ministry of Electronics and Information Technology (MeitY), 2025. Government of India. URL: <https://web.umang.gov.in/landing/>

a mobile user base of over 750 million citizens, comprising a very diverse population, and representing a much larger scale compared to conventional internet access. Nearly 60% of government services are already available online, which has in turn doubled e-governance to reach over a million in three years, a clear signal towards inclusive digital growth (IBEF, 2024).

The reduction in corruption, and the narrowing of the digital divide associated with uptake on platforms like CSCs and Digi Locker are regularly audited as part of the United Nations Development Programme's (UNDP's) governance benchmarks in India. At the national scale, Smart city mobile apps signal a new stage in the development of digital urban service maturity and complexity. The counter-hegemonic practices of the urban poor also call attention to the need for digital interventions that are responsive to actual lives, linguistic diversity and infrastructural limitations of India's diverse cities (Parida, 2021). The study is the initial secondary data work spanning all Smart cities in India and covers all Smart cities, thus filling a major research gap on how the e-governance applications have improved in terms of digital service maturity at the urban governance level.

Review of literature

Saritha (2025) undertook a comprehensive study of "Smart City 2.0" as observed in the Indian context using several case studies and secondary source information. This paper is instrumental in mapping the trend from top-down, technology-driven approaches to agile and citizen-engaged approaches. The paper studied interventions in cities such as Pune, Indore, Bhopal and Bhubaneswar to discover how mobile applications played a central role in participatory budgeting, waste management and integrated control centres. Three threads emerged from this study. These were the un-circumventable role of citizen involvement (for example, Pune's participatory budgeting through digital apps), the need to connect governance platforms across urban data sets (such as Bhopal with its ICCC mobile interface), and the importance of localising solutions. But challenges were still observed in the areas of platform integration, inclusivity and policy coherence. The study recommended a stronger smart policy, to bridge digital divide, increase citizen engagements, and focus more on green environment, transparent governance, data privacy and integrated development among the cities when adopting smart governance.

The quantitative study conducted by Hardi et al. (2025), in their detailed comparative study, though it was based on Indonesia, used numerous Indian policy references and conversations to showcase the critical role of interoperability and process harmonisation in large scale digital governance. The findings of the study demonstrated that system integration, cross-sector collaboration and iterative policy adaptation are crucial to capture both human and technology security objectives. The study was significant to the Indian context, as it provided a reminder that technical innovation in smart governance has to be an integration processes, streamlined through regulatory regimes.

Jacques et al. (2024) studied the aggregated adoption and implementation of citizen motivation in forming Smart Indian cities. This study revealed and recognised the current 'hotspot' clusters in academic discourse – to include the adoption of mo-

bile applications for utilities, health and grievance redressal – contributes more to Big Data and IoT. The researchers suggest that these contributions moved India towards Smart governance with an increased citizen engagement and sustainability imperatives. Research clearly states that Indian cities suffer from fragmented policymaking and poor interdepartmental coordination as well as infrastructural and digital divides. Yet, the study concludes that Mobile governance platforms like Indore's Integrated Complaint Management App and Kerala's K-Smart platform have performed well in comparison to others.

Prasad (2024) provided a critical examination of the governance challenges implicit in the planning of Smart cities in India. The study detailed how the rapid, top-down implementation of Smart Cities Mission projects has created a lack of policy coherence and duplicate unconnected digital infrastructures – notably between outdated city development plans and more recent Smart city masterplans. Through a case study of Chennai, the article argued that when mobile e-governance solutions are complimented by cohesive policy initiatives they can achieve tremendous traction, whereas standalone planning frameworks lead to less effective deployment and uptake. The author also called for an immediate increase in cross-departmental co-operation, legal coherence and the linking of formal-informal divides while implementing urban policy in India.

While there is research on mobile governance, Smart city applications and digital service delivery, there is less work done to look at these platforms through a broader lens of inclusive governance as an alternative. Inclusive governance is not only about having the technology to govern, but also the need to have access to it, meaningful participation, responsiveness and inclusion of different social groups in the governance process (Ansell & Gash, 2008; Fung, 2006). For Smart cities, the effectiveness of digital platforms is based not only technological ability but also the ability to cater to language, digital literacy, socio-economic conditions and accessibility. Data-driven smart governance is also a significant emerging topic in the field and the integration of technology, institutional capacity, citizen participation and community-level decision making processes with digital transformation in the context of smart governance (Meijer & Bolivar, 2016). Digital India, UMANG, DigiLocker and Smart Cities Mission are among the various initiatives that are working to build a digital governance ecosystem in India and are at the core of the digital governance ecosystem and democratisation of digital governance, so that people can be more involved in how things are done in their cities and enhancing their ability to contribute to digital governance. Mobile governance applications are now part of a larger digital public infrastructure that connects citizens to public services through interoperable, secure, and user-centred digital ecosystems (OECD, 2023). The United Nations Department of Economic and Social Affairs (UN DESA) E-Government Survey of 2024 further emphasised that mobile-first public service delivery models have become central to improving inclusiveness, reducing transaction costs, and ensuring accessibility in developing-country contexts³ (UN DESA, 2024).

³ E-Government Survey: Accelerating Digital Transformation for Sustainable Development. United Nations Publishing. 2024. URL: <https://desapublications.un.org/publications/un-e-government-survey-2024>

Table 1

Summary of literature review

Author(s) & Year	Focus Area	Methodology	Key Findings/Insights
Hardi et al. (2025)	Conducted cross-country comparative study on digital interoperability and governance integration (India, Indonesia)	Quantitative comparative analysis	Interoperability and collaboration are essential for effective mobile governance outcomes
Saritha (2025)	Conceptualisation of “Smart City 2.0” in Indian cities i.e., Bhopal, Bhubaneswar, Pune and Indore	Qualitative case study method and secondary data analysis	Emphasised citizen-centric governance through mobile platforms for waste management, and participatory budgeting
Dai et al. (2024)	Systematic review of literature of 117 studies on transformation of Smart cities	Systematic literature review (SLR)	Highlighted the role of mobile applications in service delivery and found that the Smart City progress/success depends on the parameters of governance readiness, digital interoperability and citizen participation
Soriano et al. (2024)	Social justice, community empowerment and inclusive governance	Conceptual analysis	Conceptualised inclusive governance as a model based on the principles of social justice, pluralism, participation, equity etc. which enhances democratic legitimacy through collaborative decision-making
Jacques et al. (2024)	Engagement of citizens in adoption of mobile apps in Indian Smart cities	Empirical synthesis and policy mapping	Focus on mobile applications for grievances redressal, health and utilities as major drivers of citizen participation. They found digital inequality as a persistent issue in adoption of mobile applications
Banerjee (2023)	Evaluation of service delivery through Smart city apps in India	Survey-based study across 10 Indian cities.	Found that there was an uneven mobile app adoption due to poor interface design, lack of awareness and language barriers
Annahar et al. (2023)	Conceptualise inclusive governance and synthesises governance principles	Bibliometric review	They revealed that inclusive governance evolved from various governance paradigm. Identify key governance principles underpinning inclusive governance

Source: Compiled by the authors based on the reviewed literature.

The reviewed literature highlights notable progress in mobile-enabled governance but simultaneously points to fragmentation, uneven adoption, and gaps in interoperability across Indian cities. However, very few studies undertake a systematic national comparison of all 100 Smart cities using secondary datasets. This study addresses this gap by offering a cross-city assessment of app availability, citizen engagement, inclusivity, and governance maturity across the entire Smart Cities Mission landscape.

Research methodology

The purpose of this paper is to provide an integrated assessment on the adoption and impact of mobile governance applications as enabler for citizen-centric services, aimed at Smart cities in India. The study examines both the scope (national reach) and depth (sophistication of app features, inclusiveness and user engagement) of digital service platforms developed under the national initiatives Smart Cities Mission (SCM) and Digital India. Global assessments have increasingly recognised mobile governance as a key driver of public sector modernisation, particularly in countries undergoing rapid urbanisation (UNDESA, 2024). The scope of this study covers 100 officially endorsed Smart cities, and includes an analysis of inter-city differences, platform maturity, and the extent to which governance steers or blocks citizen engagement. Additionally, the research also covers accessibility, equality, policy harmony and strategic usage of ICT through e-governance implementation. It examines the varieties of digital governance, contrasting platform features as well as adoption metrics and feedback loops across cities and states.

Inter-coder reliability checks were conducted during the coding of app features, inclusivity indicators, and service maturity parameters. The coding framework was applied consistently across all identified applications, and coding decisions were cross-verified using multiple secondary data sources to ensure reliability⁴. The majority of previous research is case-based or locally focused leaving an evident absence of thorough national-level examination of mobile e-governance in the context on Smart cities. The ‘decentralisation’ and digitalisation of governance demand rigorous comparative research which provides insights for decision-makers, city-managers and design engineers of the digital platforms into what works as well as against repeating past mistakes. This study is aimed at addressing this important gap through secondary data analysis and use of two indicators for measuring inclusivity based on pan-India data as well the extent to which citizen-centric features were effective in practice, concerning app adoption.

Research objectives

1. To analyse the presence and accessibility of Smart governance mobile applications in 100 Smart cities across India.
2. To evaluate citizen engagement, user uptake (downloads, ratings) and service maturity of Smart governance platforms.
3. To assess geographical spread and inclusiveness of smart governance applications.

Research questions

1. How do mobile applications differ across Smart cities in terms of coverage, ease-of-use and accessibility?

⁴ Coding refers to the systematic classification of application features, service functions, accessibility indicators, and governance attributes into predefined analytical categories. Inter-coder reliability refers to the consistency with which these categories are applied during the coding process, thereby improving the reliability and comparability of the analysis.

2. What trends can be drawn from citizen engagement metrics (such as app downloads, user ratings and feedback) and digital service maturity at the city level?
3. To what extent do these mobile applications promote inclusive, equitable and integrated in urban governance, service delivery and policy goals?

Research framework

The research is grounded upon (a) citizen-focused governance theory and (b) the smart governance framework.

Citizen-focused governance theory focuses on the supremacy of participatory, fair, and responsive government operations, measuring the efficacy of a given policy not just by its success in administrative terms but also by the quality of citizen experience and participation. In light of this paradigm, digital transformation is assessed according to the potential for promoting stakeholder engagement, civil participation and empowerment particularly amongst those who are less advantaged.

Smart governance framework, as defined by Mahmood et al., (2018) and Anthopoulos (2017), comprises collaborative data intensive process which employs ICT to enhance public service delivery, transparency and sustainable urban development. The frameworks particularly emphasise the components of: multistakeholder collaboration, outcome-based governance, data transparency and openness, dynamic feedback and policy adaptation standardisation, interoperability, and process integration.

Research design

Secondary data analysis technique was employed as the primary research method. This was applied to available official sources including (1) official government portals, (2) municipal dashboards and app store metadata, (3) city/state websites and (4) published datasets on the Smart Cities Mission Data Portal. Both quantitative and qualitative analytical approaches were applied. The quantitative method uses a statistical analysis (download counts, rates, service indices), and the qualitative content analysis examined the functionality of applications, user interface features, stakeholder feedback and policy integration analysis.

Secondary data analysis is widely used in international digital governance studies (OECD, 2023; UN DESA, 2024) and is therefore appropriate for comparing city level service maturity and public-platform performance.

Samples: Table 2 below lists the 100 Smart cities in India, given by Ministry of Urban Development GOI, under the Smart Cities Mission. All 100 cities notified under the Smart Cities Mission were included, ensuring complete national coverage.

Table 2

List of 100 Smart cities

State / UT	Smart cities
Andaman & Nicobar Islands	Port Blair
Andhra Pradesh	Kakinada, Tirupati, Visakhapatnam
Arunachal Pradesh	Pasighat
Assam	Guwahati

State / UT	Smart cities
Bihar	Bhagalpur, Bihar Sharif, Muzaffarpur
Chandigarh	Chandigarh
Chhattisgarh	Bilaspur, Raipur
Dadra & Nagar Haveli Daman & Diu	Diu, Silvassa
Delhi (NCT)	New Delhi (NDMC)
Goa	Panaji
Gujarat	Ahmedabad, Dahod, Gandhinagar, Rajkot, Surat, Vadodara
Haryana	Faridabad, Karnal
Himachal Pradesh	Dharamshala
Jharkhand	Ranchi
Jammu & Kashmir	Jammu, Srinagar
Karnataka	Belagavi, Davanagere, Hubballi-Dharwad, Mangaluru, Shivamogga, Tumakuru
Kerala	Kochi
Lakshadweep	Kavaratti
Madhya Pradesh	Bhopal, Gwalior, Indore, Jabalpur, Sagar, Satna, Ujjain
Maharashtra	Amravati, Aurangabad, Kalyan-Dombivli, Nagpur, Nashik, Navi Mumbai, Pune, Solapur, Thane, Greater Mumbai
Manipur	Imphal
Meghalaya	Shillong
Mizoram	Aizawl
Nagaland	Kohima
Odisha	Bhubaneswar, Rourkela
Puducherry	Puducherry
Punjab	Amritsar, Jalandhar, Ludhiana
Rajasthan	Ajmer, Jaipur, Kota, Udaipur
Sikkim	Namchi
Tamil Nadu	Chennai, Coimbatore, Dindigul, Erode, Madurai, Salem, Thanjavur, Tiruchirappalli, Tirunelveli, Tiruppur, Thoothukudi, Vellore
Telangana	Greater Hyderabad, Greater Warangal
Tripura	Agartala
Uttar Pradesh	Agra, Aligarh, Bareilly, Jhansi, Kanpur, Lucknow, Moradabad, Prayagraj, Saharanpur, Varanasi, Gorakhpur, Rampur
Uttarakhand	Dehradun
West Bengal	New Town (Kolkata), Bidhannagar, Durgapur, Haldia

Source: List of Smart Cities. URL: <https://smartcities.data.gov.in/about-us>



Figure 1: Selected cities under Smart Cities Mission

Source: URL: <http://mapsofindia.com> (Maps of India, 2018).

The secondary data were carefully and systematically sourced from: (1) Smart Cities Mission Data Portal: compilation of city-wise catalogues, urban service datasets, performance indices and feedback stories for all the 100 Smart cities. (2) City and state government websites: used to collect App Links, descriptions, functionality, integration status. (3) App Store metadata (Google Play, Apple App store): Quantification of number of downloads, user ratings, reviews and last update. (4) Municipal dashboards and open data API: It comprised metrics such as Ease of Living, Municipal Performance Index, Data Maturity Assessments and citizen feedback indicators. (5) Existing literature and policy reports: offering historical, contextual and comparative backdrop to some of the cities' selections and platforms.

The data analytical parameters include: (1) Accessibility: addresses application availability (apps are released, working, and consistently updated), cross-platform availability (Android and iOS), multi-language support and ease of use. (2) Service offered: range of services (municipal bill payment, grievance redressal, certificates, public information alert notifications and advisories, etc.) and integration

with other government platforms (UMANG platform, Digi Locker MyGov App). (3) Citizens' engagement: based on the total number of downloads, user ratings and reviews about the application, active feedback mechanisms like forum or complaint upload in the application and whether there is evidence of two-way communication, i.e. opinion polls, surveys or push notifications. (4) Service maturity: how advanced the platform features are (automation, real-time tracking, customised alerts), how complete are functionalities provided, reliability, security (privacy policies) and transparency of data. (5) Geographical dispersion and equity: comprehensive analysis of adaptation levels (service access and adoption) across cities and regions in terms of demographic (age, gender, and socio-economic groups) and infrastructure readiness. A composite Equity Score (1–10) was derived using multilingual support, accessibility, inclusiveness features included in the package, citizen participation mechanisms, service integration and user adoption metrics. (6) Inclusivity and representation: this theme covered the relative participation and use by marginal groups (women, migrant labour, urban poor, disabilities), inclusiveness of app design, and initiatives addressing the digital divide. (7) Aligned to urban governance: support for municipal administration city-structure (ICC, CC, pan-city smart infrastructures (sensor network / traffic), utility/social/weather/public safety). (8) Policy and regulatory analysis: examination of legal policies, privacy protection, open data practices, standards for interoperability, and national digital vision.

Secondary data were collected using a 4-stage method:

Stage 1: Smart Governance App Identification: leverage city/state portals and Smart Cities Mission Data Portal to track mobile apps available per city.

Stage 2: App Store Data Collection: download, and review stats; aggregation of user feedback as well as verifying availability via Google Play and Apple App Store APIs.

Stage 3: Extraction of Performance Indexes: indices on service delivery, transparent governance and ease of living were collected from municipal dashboards and Smart Cities Data Portal.

Stage 4: Feature and Inclusivity Coding: each application was coded for the presence of features, access for more marginalised populations, language strength and national platform.

Data obtained from different sources were cross-verified and compared to ensure consistency, accuracy, and reliability. Where discrepancies were identified between app-store metrics, municipal dashboards, and official reports, the most recent and officially verified information was retained.

Both quantitative (statistical) and qualitative (thematic) approaches were applied in the study: (1) Descriptive statistics was used to compare download rate, service diversity frequency and engagement metrics. (2) Tables were formed to show the differences between cities in terms of access, maturity and feedback. (3) Detailed analysis was employed to understand the features, app descriptions, user ratings/ reviews and feedback forums were content coded and analysed for transparency, inclusivity and satisfaction themes. (4) Geospatial mapping was used to underpin the interpretation of the mobile governance platforms adoption levels, service penetration and indicators of digital divide. (5) Existing smart

governance policy analysis was done to study the framework regulation, interoperability policies and cross-references to all other digital government public infrastructures.

Validity and reliability

The methodological quality of the study was ensured by using data only from truly official sources and peer-reviewed literature. This was to ensure consistency in coding and analysis through standard data.

The coded information was cross-verified against updates available on the Smart Cities Mission Data Portal⁵ and official municipal e-governance portals to ensure data accuracy, consistency and reliability throughout the study. Smart data collected from app stores and play stores were verified by cross-comparison and direct links with municipal dashboards.

Ethical considerations

As only publicly available secondary data are used within the study, there were no risks of privacy or confidentiality. All platforms examined have been based on a vision that focuses on transparency, openness and citizens' empowerment, in line with the national requirements for privacy regulation and open governance.

Limitations of the study

1. Completeness of data: not all city platforms have detailed download metrics or granular user feedback.
2. Context-dependent: the infrastructure, literacy and language situations vary drastically, which can create non-comparability of citizen-engagement metrics.
3. Technological change: it is also possible for mobile app functions and counts to change more rapidly than publication cycles would permit for a full longitudinal analysis.

Data analysis

The analysis follows the three research objectives of the study, done with collected secondary data related to e-governance apps metrics, feedback, download counts, ratings, and governance integration.

Objective 1: Mobile governance platforms Availability, Diversity, and Accessibility

App diversity in collaboration with accessibility creates a digital inclusion among the 100 Smart cities, motivating them to use e-governance apps.

Table 3 presents nine Smart cities that extensively use mobile governance platforms for multipurpose. Where, Bhubaneswar and Pune rank at top, with 7 different citizen centric e-governance apps, followed by Chennai, Delhi, and Indore.

⁵ Ministry of Housing and Urban Affairs. (2025). Open Data Platform: India Smart Cities. URL: <https://smartcities.data.gov.in>

Table 3

List of 9 Smart cities that use Smart governance extensively

City	No. of citizen-centric apps	Android/iOS availability	Multilingual support	Central / state portal integration (e.g., ServicePlus / e-District)
Bhubaneswar	7	Yes	Yes	Integrated via Odisha e-district
Indore	4	Yes	Yes	Integrated via MP e-district
Chennai	5	Yes	Yes	Integrated via TN e-district
Pune	7	Yes	Yes	Integrated via Aaple Sarkar (MH)
Lucknow	3	Yes	Partial	Integrated via RTPS / UP COP
Kochi	3	Yes	Yes	Integrated via Kerala e-district
Delhi	4	Yes	Yes	Integrated via Delhi e-district / UMANG
Vishakhapatnam	2	Yes	Partial	Integrated via AP Seva portal
Patna	2	Yes	Partial	Integrated via Bihar RTPS

Source: This table is prepared by the authors based on an analysis of Smart City Portals, mobile applications available on Google Play and Apple App Store, and state e-governance service integrations platforms as of 2025.

Table 4

List of mobile governance platforms and their multipurpose usage

City	Unified App / portal name	Multipurpose features
Bhubaneswar	Bhubaneswar.Me	Grievance, payments, certificates, public info, urban data
	Sachetak	Health, alerts, civic surveillance
	SAFA Bhubaneswar	Sanitation, Waste management, civic complaints
	BhubaneswarOne	Location info, public maps, utilities
	Bhubaneswar Me Officer Portal	Officer dashboard, workflow management
	B-Active (CITIIS project)	Lifestyle, events, city activities
	Chalo app, Smart Traffic & Transit	Traffic, public transport, mapping
Indore	Indore 311	Grievance, urban services, civic issues, feedback, etc.
	DigiPIN	Address identity, QR code, property verification
	Citizen Bus (Indore)	Public transport, scheduling, fares
	Indore Waste Management (Kachra Bill Online Payment)	Waste tracking, schedules, complaints

City	Unified App / portal name	Multipurpose features
Chennai	Namma Chennai App	Grievance, payments, certificates, urban alerts
	Smart Chennai	Multiple urban services, health, disaster response, etc
	Smart Bikes Chennai	Public bike sharing, location, fares
	Chennai Kudineer	Water supply, Sewerage, issue reporting
	WhatsApp chatbot	Certificates, complaints, public info, quick requests (32+ mini-services)
Pune	Pune Connect	Grievance, info, quick links
	Pune Smart City	My Gov, e-gov info, Smart City Projects
	PMC Care	Health, COVID services, alerts
	PMC Urban App	Building permission, public services, grievances redressal, property tax & bills, traffic & public transport
	PMC ISWM	Refuse collection tracking, complain registration, awareness & updates, connect support
	PMC Road Mitra App	Register road complains, potholes, status tracking
	PTP App	Traffic alerts, incidents causing jams
Lucknow	Lucknow Smart City App	Service requests, complaints, info, billing
	Lucknow One	24*7 Helpline, register complaints, civic services
	Smart Parking (Parkmate)	FASTag Parking availability, maps
Kochi	Smart Kochi App	General info, complaints, billing, certificates
	Kochi 1 App & Kochi Smart City Portal	Kochi 1 App- One stop app for all payment and travel needs in Mochi. Multi-modal transport ticketing (Kochi Metro), civil registration, solid waste clearance requests, municipal open data visibility.
	My Kochi (Heal Kochi)	Integrates various online services for citizens of Kochi, i.e., Septage collection system, complaints, registration, etc.
Delhi	NDMC 311 App	Grievance, public info, billing, multiple services
	Delhi ePay	Municipal payments, e-documents
	My Delhi Grievances	Complaint registration and tracking
	Delhi E-Monitoring	Tracks projects, tasks, checks and complaints related to infrastructure development
Vishakhapatnam	One Vizag – One App	Unified mobile app for civic services, complaints, payments, e-challan, etc.
	GVMC Citizen portal	Grievance lodging, building plan permission status tracking, municipal property tax processing, sanitation scheduling.
Patna	Patna Smart City portal	Service requests, complaints, civic services
	My Patna	Complaint, Helpline number, civic services

Source: Compiled by the author from official Smart city websites, municipal corporation portals, Google Play Store listings, Apple App Store listings, Smart Cities Mission documentations, and state e-governance portals of 2025.

Table 4 lists the different multipurposes served by the mobile governance platforms in the most prominent 9 Smart cities ranging from health alerts, workflow management, municipal alerts, property verification to disaster responses and waste tracking. On the other hand, there still persists a disparity in accessibility, as Android platforms dominate with > 95% of all Smart city governance apps, while the same is not available for iPhone or iOS users, around the nation. Similarly, UMANG acts as the national integrated app for Smart governance, which has performed well in cities, but the same app seems to have performed weakly in smaller cities. Data obtained from the Smart cities Mission Data Portal further shows that most of the Mobile governance platforms are continuously updated to ensure data transparency and privacy (Ministry of Housing and Urban Affairs, 2022).

Objective 2: Citizen engagement and adoption pattern

The citizen engagement statistical data are important to understand the Smart governance maturity. The play store and app store analytics reveals a major variation in download counts, user ratings, priorities, and demographic diversities. The Smart city Indore ranks the top with 2.5 million downloads, 4.7 rating, and 28,960 user reviews followed by Bhubaneswar, Chennai, Pune, Lucknow, Surat, Hyderabad, Ahmedabad, Jaipur, and Coimbatore. Coimbatore ranks last in the list with only 0.8 million downloads, 4.7 rating and 13,912 reviews.

Table 5

User engagement in top 10 Smart cities

City	Total downloads (million)	Ratings (avg)	User reviews (count)
Indore	2.5	4.7	28,960
Bhubaneswar	2.1	4.6	25,573
Chennai	2.0	4.8	28,340
Pune	1.8	4.5	21,596
Lucknow	1.4	4.2	19,003
Surat	1.2	4.4	17,278
Hyderabad	1.1	4.6	18,331
Ahmedabad	1.0	4.5	16,514
Jaipur	0.9	4.3	15,811
Coimbatore	0.8	4.7	13,912

Source: The data compilations is based on Google Play Store, App Store Spy and Apple App Store data of 2025.

Note: App Store analytics are indicative of cumulative lifetime downloads and running averages compiled from the Google Play Store and iOS App Store metrics. Data are normalised to standard reporting categories to account for platform variations.

These variations indicate that higher app adoption correlates with metropolitan size, local institutional capacity, and multilingual interface availability.

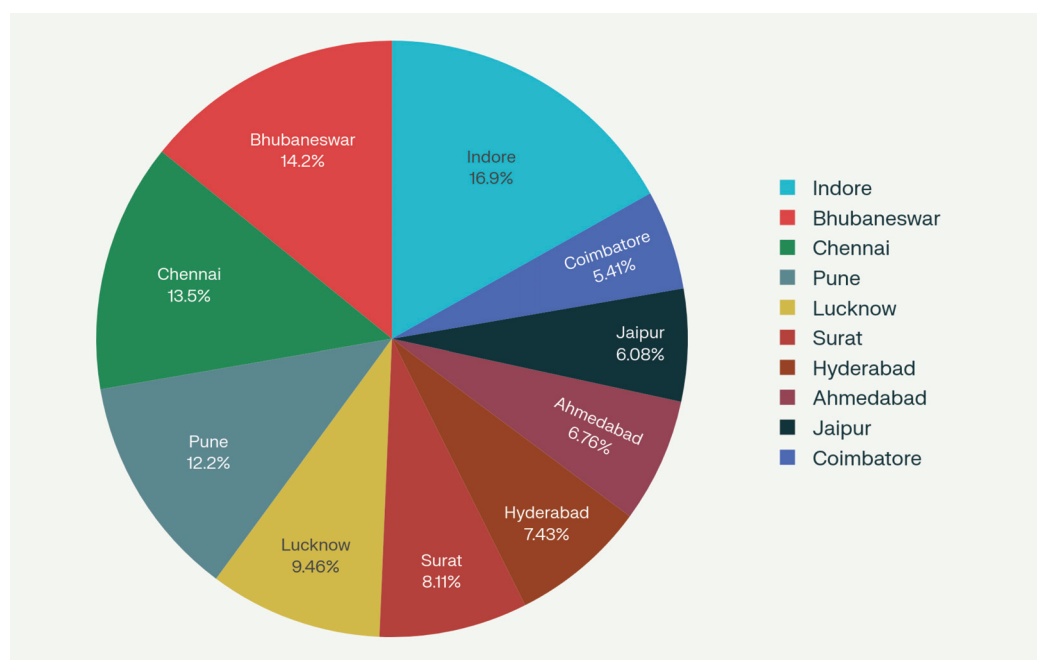


Figure 2. Percentage of Smart governance app downloaded in top 10 Smart cities

Source: Author computation and visualization based on mobile governance application download statistics compiled from Google Play Store listings, Apple App Store listings, Smart City Portals, and Municipal e-governance platforms of 2025.

The Smart cities Indore, Bhubaneswar, Chennai, and Pune collectively make up 35% of total Smart governance downloads in 2024–2025. This makes these four cities mobile governance platforms engagement leaders.

In terms of service maturity and feedback, there are several platforms and options available for the user or citizens to express their opinion through grievance forums, and ratings which accounts to 95% in most of the mobile governance platforms. Similarly, automated feedback mechanisms integrated through push notification and performance trackers act as two-way communication especially in metropolitan governance apps (UN DESA, 2024).

Table 6

Comparative adoption table

Parameter	Metropolitan cities	Tier-2 / 3 cities
Average downloads	1.7 million	0.4 million
Ratings	4.6	4.1
Average services	11	7
Feedback utilised	88%	55%

Source: Computed by the author based on Smart City mobile application data obtained from Google Play Store listings, Apple App Store listings, Smart City Special Purpose Vehicle (SPV) portals, municipal corporation websites, and Smart Cities Mission reports of 2025.

Table 6 details the mobile governance platforms adoption statistics, displaying the average download count, overall ratings, average number of services provided, and the feedbacks utilised in metropolitan cities and Tier-2 and Tier-3 cities.

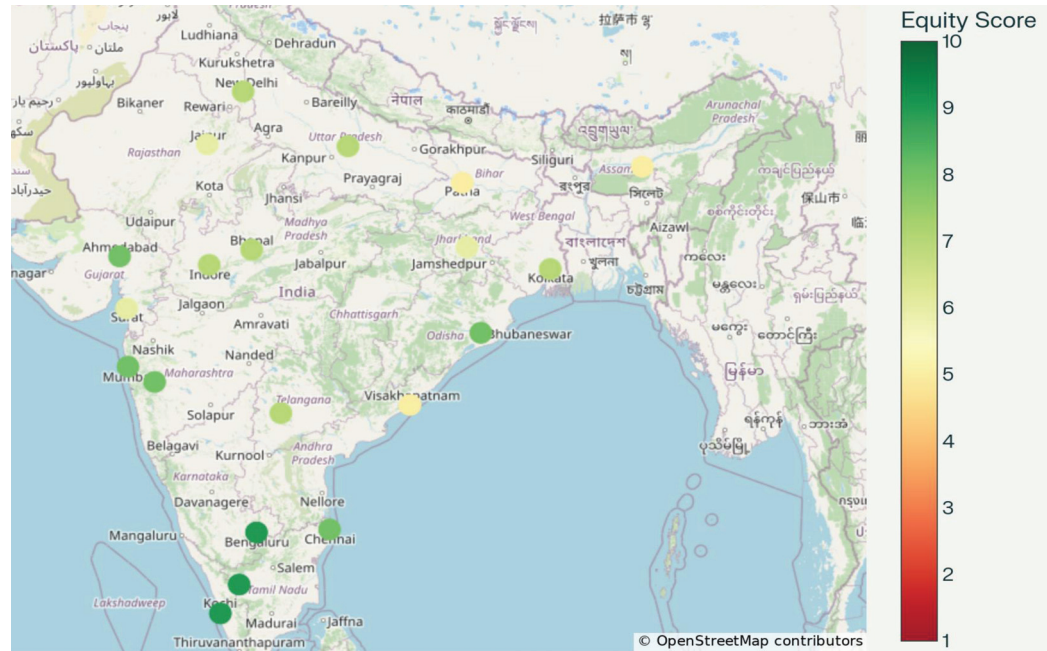


Figure 3. Geospatial heat map of Smart governance

Source: OpenStreetMap Contributors, 2026.

Objective 3: Mobile governance platforms Equity, Inclusiveness, and Regional Variation

Figure 3 illustrates the Smart governance services equity scores with geospatial heat map. The service scores were accessed by analysing every Mobile governance platform features, diversity, language availability, download rates, and inclusive metrics (women, disabled and low-income citizen usage). A wide range of progression in terms of Equity, and Digital Inclusiveness can be found more in south and western Smart cities, whereas a broader digital divide can be observed in north and interior Smart cities (Bhoda, 2024; Caragliu, 2023).

Table 7 details the five top most performing smart cities in smart governance, among which the State of Kerala (Kochi and Thiruvananthapuram) and Karnataka (Bengaluru and Mangalore) rank with the score 9, followed by Maharashtra (Pune, Navi Mumbai and Nagpur) and Tamil Nadu (Chennai and Coimbatore) scoring. The mid-score of 5–6 is taken by Central NE Belt (Lucknow, Patna and Ranchi). The data also shows the important barriers that lie in between the smart cities and smart governance, which ranges from minor language accessibility to affordability of mobile phone or internet.

Several policy implementations including PMGDISHA Digital Literacy Programmes have acted to remove smart governance barriers, expanding smartphone availability along with e-literacy in over one-third of Tier 2 and 3 Smart cities. The success case study includes: (1) Pune which has an upgraded equity score

of 7–8 after the implementation of the PMGDISHA literacy programme (Bhoda, 2024). (2) Kochi has achieved complete multilingual support from government. (3) Ahmedabad has introduced “inclusive smart governance interface mode” for visually impaired citizens (Arora, 2025).

Table 7

Equity score of top Smart cities⁶

Region	Equity score (1–10)	Top performing Smart cities	Main barriers
Kerala	9	Kochi, Thiruvananthapuram	None reported
Karnataka	9	Bengaluru, Mangalore	Minor language accessibility
Maharashtra	8	Pune, Navi Mumbai, Nagpur	Digital literacy gaps
Tamil Nadu	8	Chennai, Coimbatore	Patchy rural extension
Central-NE Belt	5–6	Lucknow, Patna, Ranchi	Infrastructure, affordability

Source: Authors computation based on smart governance indicators compiled from Smart Cities Mission portal, municipal e-governance platforms, mobile governance applications, citizen participation mechanisms, multilingual accessibility features, service integration levels, and user adoption statistics.

Disparities and barriers in accessing smart governance mostly persist in Smart cities with larger migrant populations like Delhi and Lucknow, as they are seriously affected by infrastructural deficits. These disparity patterns require a well sustained cross-sectoral collaboration and direct community engagement in policy formation of smart governance (Hardi et al., 2025; Mullick, 2022).

The degree of smart governance maturity is statistically calculated⁷ based on the facts of automation, completeness, reliability, and integration of Mobile governance platforms. Overall, 28 percent of all Mobile governance platforms in Smart cities offer end-to-end online solutions for certificate downloads, payments, grievance redressal, and urban data without any requirement for physical interactions.

Among the 100 Smart cities, only the top 5 of them have high to medium e-governance automation with national and international integration, as mentioned in Table 8. Pune, Bengaluru and Indore have the highest smart governance automation, and all the 5 Smart cities have high data security, and API availability. Only Bhubaneswar and Coimbatore, have medium smart governance automation. Over 65 percentage of metropolitan Mobile governance platforms are upgraded to RDBSMS-integrated backend,⁸ supporting real-time updates.

⁶ Equity scores were calculated through a composite assessment of six dimensions: multilingual accessibility, accessibility features, inclusiveness provisions, citizen participation mechanisms, service integration, and user adoption indicators. Each dimension was comparatively assessed and aggregated to generate a score ranging from 1 (low equity) to 10 (high equity).

⁷ The Smart Governance Maturity score was derived from a comparative assessment of platform automation, service completeness, operational reliability, interoperability, and integration with wider digital governance ecosystems.

⁸ RDBMS refers to a Relational Database Management System, a database architecture that stores and manages structured information through interconnected tables, enabling efficient data retrieval and real-time service updates.

Table 8

Smart governance automation and integration

City	Automation level	Data security	API availability	Integration w / national platforms
Pune	High	Full	Yes	Yes
Bengaluru	High	Full	Yes	Yes
Bhubaneswar	Medium	Full	Yes	Yes
Indore	High	Full	Yes	Yes
Coimbatore	Medium	Full	Yes	Yes

Source: Compiled by authors based on Smart City Integrated Command and Control Centre (ICCC) reports, Smart Cities Mission documentations, National Urban Digital Mission (NUDM) guidelines, municipal e-governance portals, APO\I-enables citizen service platforms, and integration with national digital platforms (UMANG, DigiLocker, Aadhaar-enabled services, etc).

Mobile governance platforms with integrated feedback systems (direct polling, complaint forms or forums, and public suggestion crowdsource) had performed 35% more due to higher satisfaction along with 20% increase in repeated usage. The participatory budget models introduced in Pune and Bhopal have encouraged citizen-led resource allocation. These have increased citizens' trust and engagement in mobile governance platforms. Table 9 clearly details the increase in citizen engagement, after the introduction of several citizen participatory features in selected 5 Smart cities (OECD, 2023).

Table 9

Impact of participatory features in mobile governance platforms

City	Participatory Features	Impact on Engagement
Pune	Polling, budget forums	+30%
Bhopal	Complaint dashboards, auto-responses	+24%
Chennai	Notification-based surveys	+21%
Bengaluru	Urban data mapping, collaborative forums	+22%
Kochi	Open data APIs, feedback forms	+19%

Note: Percentages indicate the relative increase in unique user interactions recorded within a 12-month post-implementation window of the participatory features (Ministry of Housing and Urban Affairs, 2023).

Source: Authors' analysis based on citizen participation featured available in Smart City Mobile governance platforms, municipal e-governance portals, user engagement reports, and Smart Cities Mission documentation (Ministry of Housing and Urban Affairs, (2025); Pune Smart City Development Corporation Limited, (2025); Bhopal Smart City Development Corporation Limited, (2025); Bengaluru Smart City Limited, (2025); Chennai Smart City Limited, (2025); Cochin Smart Mission Limited, (2025); India Urban Data Exchange, (2025)).

The 100 Smart cities are statistically analysed based on download ratios, equity scores, maturity features, and integration, which is shown in Table 10. The top

50 Smart cities have a good score of 65% in including women and poor in Smart governance, while the bottom 50 Smart cities have only 21% of inclusiveness.

Table 10

Inter-city comparison

Parameter	Among top 50 SMART cities	Among bottom 50 SMART cities
Downloads per urban pop.	45%	7%
Equity score	8.3	5.1
Feature maturity Index	0.92	0.61
Inclusivity (women, poor)	65%	21%
Feedback Utilisation	87%	34%

Source: Authors computation based on Smart city mobile governance apps, Smart Cities Mission reports, municipal e-governance portals, citizen participation mechanisms, service integration indicators, inclusivity measures, and urban population statistics of 2025 (National e-Governance Division, (2025); Open Government Data Platform India, (2025)).

These parameters of integration show the need for: (1) Open and interoperable mobile governance platforms. (2) Equal and democratic feedback mechanisms. (3) Regular user-based updates. (4) Multilingual platforms or interfaces. (5) Proactive e-literacy programs.

Policy analysis clearly reveals a strong alignment between top-performing Smart cities and smart governance objectives. There is more need for the policies to be re-checked and reframed based on the requirements of citizens or users, which is more of governance equity and maturity (Kaiser, 2024; OECD, 2023).

Across the 100 Smart cities, mobile governance performance shows a clear regional pattern, with southern and western cities demonstrating stronger service maturity and inclusiveness. This suggests that institutional readiness, municipal investment capacity, and citizen digital literacy remain decisive factors in shaping mobile governance outcomes.

Synthesis for future research

The combined/amassed evidence suggested that mobile applications have transitioned from being peripheral instruments to becoming fundamental components of Smart governance. Nevertheless, their potential remains partially due to deficiencies in the integration, inclusivity and governance preparedness.

Future research should:

- I. Examine the development of integrated assessment frameworks that combine technical, social and governance matrices.
- II. Conduct comparative longitudinal analyses across Indian cities or urban centres to assess/evaluate outcomes over time.
- III. Explore the AI-driven and data secure mobile governance framework aimed at enhancing the personalisation of services, citizen trust, privacy protection, and promoting sustainable digital inclusion.

Discussion

The results reveal substantial differences in the maturity, accessibility, and citizen uptake of mobile governance platforms in India's Smart cities. Indore, Bhubaneswar, Chennai, and Pune were the cities that performed best in terms of application diversity, user engagement, service integration, and citizen engagement. These results are generally in line with previous studies which identified these cities as leaders in citizen-centred digital governance as well as integrated urban management systems (Saritha, 2025). The high levels of adoption in these cities suggest that the effectiveness of mobile governance is not just about the implementation, but also about the capability of institutions, coordination of operations, and investment in digital services.

From the smart governance framework's perspective, interoperability, integration, and responsiveness are important factors in governance outcomes. Cities with stronger digital ecosystems were more likely to provide multiple services through unified platforms, keep feedback systems going, and integrate municipal services in a broader digital governance strategy. Tables 8, 9, and 10 show that cities with more automation, integrated platforms, and participatory features also had higher levels of citizen engagement and even more frequent use of the technology. This is consistent with the argument that smart governance is most effective when technology is integrated into systems of institutional processes and not used as an autonomous administrative tool. The results thus support existing research that focuses on collaboration, data integration, and adaptive governance as key parts of a successful digital transformation.

The study also raises important issues related to inclusiveness and equity. While mobile governance applications have enabled access to public services to scale, the benefits are not equally shared between cities and population groups. Regional differences can be seen in the way multi-language support, access, and citizen involvement in the south and west are more effective than in the north and interior. Digital governance outcomes are influenced by digital literacy, infrastructural readiness, affordability, and institutional support. These patterns are consistent with how we are aware of the digital divide, which suggests that technological access does not guarantee equitable access or meaningful participation.

These findings are in line with inclusive governance principles in this regard, as accessibility (language diversity) and user-centred design are at the heart of effective citizen participation. The results also suggest that mobile governance applications are becoming more and more part of digital public infrastructure. Integration with national platforms like UMANG, E-District Services, DigiLocker, and other interoperable digital services has enabled cities to provide better services and to do so transparently. More integrated cities reported improved service maturity and citizen engagement. Mobile applications should therefore be seen not just as technology-based tools but as part of a broader governance system for service delivery, accountability, and public participation. This convergence between municipal applications and national digital ecosystems is crucial for more integrated and citizen-oriented governance.

The findings indicate that mobile governance is a crucial tool for improving citizen-state cooperation within India's Smart Cities Mission. Regional inequalities, accessibility barriers, and uneven institutional capacity persist in the long term and

will be key to the success of smart governance in the future: to achieve greater inclusiveness, digital literacy, multilingual accessibility, and inter-agency coordination. Addressing these challenges will be essential for ensuring that the benefits of digital governance are shared more equitably across diverse urban populations.

Conclusion

This study offers a comprehensive cross-city assessment of mobile governance platforms across India's 100 Smart cities. The analysis reveals substantial disparities in app availability, inclusiveness, service maturity, and citizen engagement, with metropolitan and southern/western cities leading the digital transformation landscape. Cities such as Indore, Bhubaneswar, Chennai, and Pune demonstrate how integrated digital ecosystems can enhance transparency, responsiveness, and public participation. At the same time, Tier-2 and Tier-3 cities continue to face constraints relating to language accessibility, infrastructural gaps, and fragmented policy implementation.

In addition, mobile governance applications have been shown to play a key role in promoting inclusive and integrated urban governance in India's Smart cities. Those cities which are better integrated in multilingual support, citizen feedback, service integration, and platform interoperability were more engaged and exhibited good governance. Municipal apps and national digital platforms such as UMANG have further increased the reach of public services. But the results show that technological advancement does not guarantee inclusiveness. To achieve equitable outcomes, digital governance platforms need to be able to be institutionalised, digital ready, user-friendly and can address structural socio-economic and technological barriers.

The findings underscore that the success of smart governance depends not merely on technological deployment but on institutional coordination, interoperability, and equitable design. As India advances towards a more data-driven urban governance model, sustained investment in e-literacy, multilingual platforms, and integrated digital architectures will be essential. Strengthening these foundations will ensure that mobile governance evolves as a genuinely citizen-centric mechanism capable of supporting inclusive and accountable urban development.

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ASSESSING THE IMPORTANT FACTORS OF AI TECHNOLOGY FOR IMPROVING THE EFFICIENCY OF DIGITAL GOVERNANCE: A CASE STUDY OF AI CHATBOTS IN PUBLIC ADMINISTRATION SERVICES

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Abstract. This study investigates the role of AI chatbots in enhancing digital governance efficiency in developing countries, with a focus on organisational, governance, and ethical factors influencing technology adoption. The research employs the Technology Acceptance Model (TAM) and analyses survey data using Partial Least Squares Structural Equation Modelling (PLS-SEM) among public sector employees. The findings indicate that perceived ease of use and perceived usefulness significantly influence the attitudes of users towards the use and behavioural intentions to use AI chatbots. In addition, organisational and contextual factors such as efficiency and accountability, leadership and motivation, clear strategy and mindset-change, ethical

AI regulation and adoption, and data management and security positively shape the perceptions of users of AI chatbot usefulness and their ease of use. This study contributes to the literature by extending traditional TAM-based research, which often manages governance and institutional dimensions, particularly in developing country contexts. It also provides practical implications for policymakers and public sector managers aiming to improve service delivery efficiency through AI-enabled solutions. The results highlight the importance of aligning technological adoption with governance readiness, ethical oversight, and organisational capacity for effective AI integration in the public sector.

Keywords: digital innovation; digital government; AI chatbots; public administration; Technology Acceptance Model (TAM); developing countries.

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Introduction

In recent years, artificial intelligence (AI) technologies have emerged as a significant innovative force in various fields, including public administration systems. Its potential is to improve service delivery, increase efficiency, and increase citizen engagement. AI is driving governments around the world to increasingly embrace automated services. Applications of AI provide accurate and concise information about government services and processes (Nicolescu & Tudorache, 2022). For these reasons, these innovations are increasingly recognised as important components of digital government initiatives aimed at creating more accessible, transparent public services (Madan & Ashok, 2023). Developed countries around the world are trying to implement AI chatbots to improve the productivity of a wide range of government services and the efficiency of business operations (Aoki, 2020). However, despite these promising opportunities, the adoption of AI chatbots in the public administration within developing countries presents unique challenges such as limited technological infrastructure, gaps in digital literacy, and resistance from some organisations – often hindering the successful integration of AI technologies (Folorunso et al., 2024).

This study focuses on Uzbekistan, a developing country, to improve digitisation and digital government operations by evaluating the effective use of AI chatbots in public administration services. The digital transformation begun in early 2010 with the establishment of a practical e-government platform, and in 2024, the government adopted the “Development of AI Technologies until 2030 Strategy” which was aimed at promoting the use of digital technologies in public administration system operations. Despite governmental efforts to incorporate digital smart technologies, the determinants influencing a citizen’s acceptance and usage of AI chatbots remain underexplored (Kobilov et al., 2023). This study addresses two

important research gaps. First, despite the government's efforts to promote AI-enabled public services, there is limited empirical evidence on the factors influencing citizens' acceptance and use of AI chatbots in public administration. Second, there is insufficient research examining how the adoption of AI chatbots affects the performance and efficiency of public administration services in Uzbekistan. Addressing these gaps will contribute to a better understanding of both citizen adoption and the effective implementation of AI chatbots in digital governance, thereby supporting evidence-based policymaking and improving public service delivery (Radhakrishnan & Chattopadhyay, 2020).

This research seeks to empirically investigate the main factors that affect the efficient implementation of AI chatbots within Uzbekistan's public administration services. Data collection was conducted using the TAM model, and the integrated model data was analysed through PLS-SEM to reach the study objectives. The integrated model includes the following extended factors: perceived usefulness, perceived ease of use, attitude toward use, behavioural intention, external factors such as efficiency and accountability, leadership and motivation, clear strategy and mindset-change, ethical AI regulation and implementation, and finally, data management and security. This research not only offers important perspectives on the social factors influencing AI technologies adoption but also enhances to the scholarly literature and informs practical policy formulation. Simultaneously, it provides evidence-based strategies for governments aiming to leverage the complete capabilities of AI to enhance service provision and citizen involvement in developing nations. In addition, the theoretical model extends current research on the effective use of AI chatbots in public administration services (Celik, 2023).

Theoretical background, framework and hypothesis development

AI chatbots in public administration

The adoption and integration of AI into public administration marks a significant evolution in digital government, enabling more responsive, personalised, and efficient service delivery (Albu, 2023). Among AI applications, chatbots are automated conversational agents that use machine learning and natural language processing to interact with citizens, deliver information, and manage routine administrative tasks in real time (Wirtz et al., 2021). From a New Public Management (NPM) perspective, AI chatbots support efficiency, automation, cost reduction, and performance-oriented service provision. At the same time, within E-Government theory, chatbots facilitate the digitalisation of public services and enhance citizen-state interaction, while Digital Governance frames them as data-driven, AI-enabled instruments embedded within interconnected institutional systems. AI tools are increasingly adopted by government agencies to handle routine queries, automate service requests, and provide real-time assistance (Criado & Gil-Garcia, 2019). Despite these advantages, chatbot adoption in the public sector faces certain challenges, including data privacy, algorithmic bias, trust in automated systems, and a lack of institutional readiness (Mannuru et al., 2023). These issues highlight that the implementation of AI chatbots in government is not merely a technical effort, but a complex organisational and institutional process requiring structural adapta-

tion, interagency collaboration, and legitimacy-building among citizens. Furthermore, implementing chatbots in government requires not only technical capabilities but also organisational changes, interagency collaboration, and public trust, which is a complex task compared to private sector applications.

First, institutional resistance to innovation is evident in many developing countries due to hierarchical bureaucratic structures, rigid systems, and limited incentives for risk-taking or cross-sector collaboration (Mergel, 2019). Organisational and digital initiatives frequently hinder the systemic adoption of intelligent technologies. Second, the effectiveness of AI chatbots hinges on high-quality, interoperable, and ethically governed data. Many public sector systems in developing nations still rely on fragmented or paper-based records, lacking the digital infrastructure necessary to support AI analytics. Poor data governance including unclear data ownership, limited metadata standards, and weak cybersecurity protections can significantly compromise the performance, reliability, and fairness of AI tools (Zuiderwijk et al., 2021). Third, trust is a critical, though often underestimated, determinant of AI acceptance in public services. Citizens may be cautious of AI tools due to concerns about data misuse, surveillance, algorithmic opacity, or exclusionary decision-making (Zouridis et al., 2020).

A growing body of literature highlights a clear divergence between developed and developing countries in the adoption of AI-enabled public services. In developed economies, AI chatbots are typically deployed within mature digital ecosystems characterised by interoperable data infrastructures, strong regulatory frameworks, and high levels of citizen trust in government institutions. These conditions facilitate smoother integration of AI tools into existing service delivery systems and enable a shift toward proactive and predictive governance models. In contrast, developing and transition economies often face structural constraints such as fragmented digital infrastructure, limited interoperability between government databases, and weaker institutional capacities for data governance. As a result, AI chatbot adoption in these contexts tends to be incremental, experimental, and highly dependent on donor-supported or pilot-based initiatives rather than full-scale institutionalisation. This divergence suggests that theoretical models developed in advanced contexts may not fully capture the adoption dynamics in developing countries, where institutional readiness and governance maturity play a more decisive role than technological capability alone.

In Uzbekistan, digital transformation has been positioned as a national strategic priority through the ambitious “Digital Uzbekistan 2030” agenda, which outlines objectives related to e-governance, AI adoption, and ICT modernisation (Gulyamov et al., 2023). Government institutions have initiated several pilot projects, such as AI-driven information chatbots in public service centres and digital platforms for citizen feedback. Nonetheless, several challenges persist such as institutional data systems that remain largely unstandardised and fragmented (Sankar, 2021), and regional disparities in service provision (Van Noordt & Misuraca, 2022). These gaps introduce uncertainty for implementers and may deter broad institutional uptake or public trust in AI-enabled services (Moon et al., 2024). Consequently, this study conceptualises the integration of AI chatbots in digital government – not only as a technological innovation, but as a deeply institu-

tional and sociotechnical transformation. Guided by public administration theory, the analysis focuses on identifying the key institutional, organisational, and technological factors, the major obstacles to effective implementation, and the governance conditions shaping AI chatbot adoption in the public sector. Success depends not only on technological capabilities, but on strategic leadership, clear governance structures, digital capacity-building, mindset-change, and sustained efforts to align AI systems with public values, and expectations. Despite the growing body of research on AI-enabled public services, much of the existing literature largely assumes relatively stable institutional environments and advanced digital ecosystems. This limits its explanatory power in transition economies, where institutional constraints, administrative legacies, and uneven digital capacities play a decisive role in shaping technology adoption outcomes. By situating AI chatbot adoption within the specific institutional context of Uzbekistan, this study addresses this gap and provides context-sensitive insights into how governance structures and organisational realities influence AI technologies uptake in the public sector.

AI chatbot adoption studies and gaps

Existing literature largely overlooks the institutional constraints in developing economies. In particular, prior studies tend to underemphasise how institutional rigidity, hierarchical decision-making, and limited cross-agency coordination shape the adoption dynamics of smart digital technologies in public administration services. Consequently, existing models do not fully capture the complexity of AI implementation in developing and transition contexts. Although research on smart digital technologies in government is growing, empirical studies on chatbot adoption remain relatively scarce and fragmented. Prior studies have given limited attention to how institutional rigidity, hierarchical decision-making (Folorunso et al., 2024) and limited cross-agency coordination influence AI chatbot adoption in public administration. Some recent studies have examined AI implementation in public services using qualitative or case-based approaches (Zouridis et al., 2020). But few provide a comprehensive, empirically validated model that captures multi-dimensional factors influencing chatbot adoption. Several scholars emphasise that successful adoption of AI in government must also account for normative and institutional factors such as legal compliance, ethical governance, administrative accountability, and citizen-centric values which are often underexamined in conventional innovation models. This is especially pertinent in developing countries, where public institutions often operate within centralised, hierarchical structures characterised by limited digital literacy, fragmented inter-agency coordination, and conservative risk cultures (Mikhaylov et al., 2018). Such conditions can intensify implementation gaps, reduce the efficacy of AI tools, and undermine the trust required for widespread adoption. Moreover, current research tends to focus on developed countries with advanced digital ecosystems, such as the US, UK, and EU member states. There is a notable lack of research on how developing countries, particularly in Central Asia, are approaching the adoption of AI chatbots in public administration. These countries often face challenges, including digital infrastructure gaps, limited skilled personnel, regulatory uncertainty, and institutional inertia (Criado & Gil-Garcia, 2019). In addition, AI chatbot adoption in public administration is increasingly understood

as being constrained not only by technological readiness but also by deeper institutional and behavioural barriers.

Among these, lack of citizen trust remains a critical factor, particularly in contexts where concerns about surveillance, data misuse, and algorithmic opacity are prevalent. Equally important are weaknesses in data governance frameworks, including unclear data ownership, limited data standardisation, and insufficient cybersecurity safeguards, which collectively undermine the reliability and scalability of AI systems. Furthermore, institutional inertia – manifested through hierarchical bureaucratic cultures, resistance to procedural change, and limited incentives for innovation – continues to slow down the adoption of AI-enabled tools in many public sector organisations. These barriers suggest that AI adoption is not merely a technical diffusion process but a complex socio-institutional transformation shaped by governance quality, organisational culture, and public legitimacy.

In recent years, empirical studies and government pilot programmes increasingly showcase the transformative potential of AI chatbots in public sector settings. These AI systems are being employed to automate frequently asked questions, deliver multilingual services, manage appointments, and provide policy information, particularly in contexts where human resources are overloaded or geographically uneven (Van Noordt & Misuraca, 2022). Their ability to deliver services continuously and consistently can enhance administrative responsiveness and reduce bottlenecks in public service delivery. However, scholarly analyses underscore that the successful implementation of AI chatbots hinges on a constellation of enabling conditions: the presence of a coherent digital strategy, strong leadership commitment, effective data governance, robust cybersecurity practices, and public trust in AI systems (Wirtz et al., 2021). This study positions these institutional and governance-related factors as contextual antecedents of TAM constructs, recognising that perceived usefulness and ease of use in the public sector are not formed in a vacuum but are shaped by organisational capacity, institutional trust, and regulatory environment. Accordingly, integrating these factors into the TAM framework allows for a more comprehensive understanding of AI chatbot adoption in complex public administration settings. Therefore, this study contributes to the literature by extending the traditional Technology Acceptance Model (TAM) through the integration of institutional, organisational, and governance factors. Unlike prior studies that focus predominantly on individual-level perceptions, this research captures the multi-level nature of AI adoption in the public sector, particularly within a transition economy context. In addition, it further extends TAM by incorporating organisational and strategic factors that are particularly relevant for AI adoption in public administration. Figure 1 presents the TAM based integrated research framework for this study to identify determining factors of AI chatbots in public administration services (Davis, 1989; Venkatesh & Davis, 2000). The model also suggests a direct influence of external factors such as efficiency and accountability, leadership and motivation on PU, clear strategy and mindset, ethically AI regulation and adoption on PEU, data management and security on AT, and also assesses the relationships between TAM constructs PEU impacts on PU, PU impacts on AT, PEU impacts on AT, AT influences on BI to effective adoption of AI chatbots in public administration (Gordon, 2001).

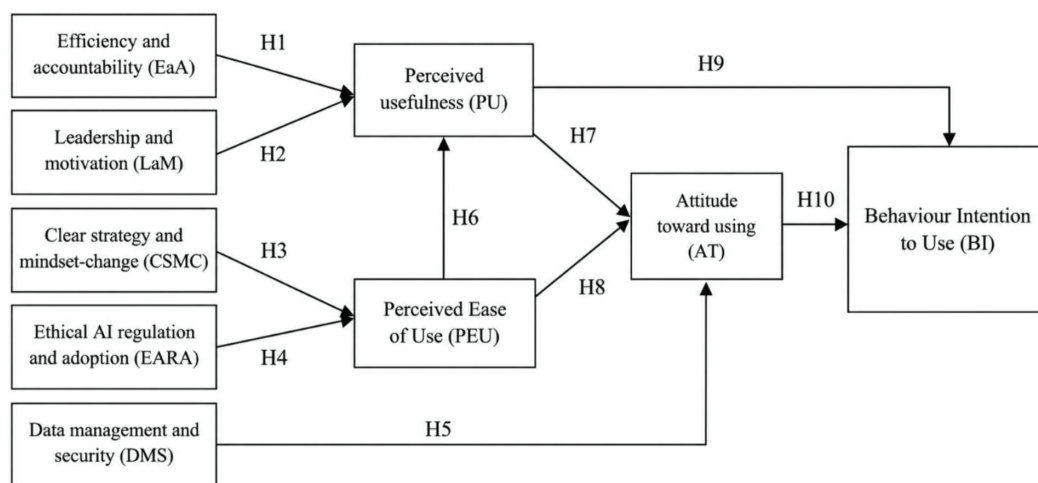


Figure 1. Conceptual model

Source: SmartPLS, developed by the authors.

Hypothesis development

The TAM is the theoretical foundation of this study, which was originally proposed by Davis (1989). TAM provides a lens through which we can understand the primary acceptance and adoption of smart digital technologies by AI-chatbots (Venkatesh & Davis, 2000). According to this model, adoption of new technology is impacted by two main factors: “perceived usefulness (PU)” and “perceived ease of use (PEU)” – which serve as the primary predictors of users’ Attitude toward using (AT), and Behavioural Intention (BI) to adopt AI chatbots (Venkatesh et al., 2003). In the context of our research, we suggest that user’s perceptions of AI chatbots utility in enhancing efficiency processes (perceived usefulness) and the simplicity of integrating AI chatbots into exiting public services (perceived ease of use) will significantly influence their attitude toward and intention to use AI chatbots in their public service delivery practices. Understanding key determinants influence user acceptance and usage intentions of AI tools, and change organisational processes, structures, and cultures. We examine integrated TAM constructs and research hypotheses based on this structure within the study.

Efficiency and Accountability (EaA)

Effective use of AI chatbots will increase automation of government work, re-design of government processes, free up staff resources, and ultimately lead to higher efficiency. At the same time, it will also increase the efficiency and accountability of government services (Wirtz et al., 2021). When users perceived that AI chatbots improve operational transparency and responsibility, they view it as more useful. On the other hand, efficiency and accountability are critical pillars that drive the successful integration of new technologies, include intelligent systems. Higher levels of efficiency and accountability contribute to more effective adoption of AI chatbots by optimising resource allocation, improving service delivery, and enabling a more responsive approach to evolving public demands. Additionally, by automating routine tasks, AI allows public officials to dedicate greater attention to complex, value-added

activities, potentially elevating the overall quality of services provided to citizens. From an accountability point, AI chatbots must ensure transparency and traceability, reinforcing trust in digital public services (Lin et al., 2023). In this regard, AI chatbots not only streamline operations but also enhance organisational responsibility by providing fast, consistent information, guiding users through public services, and learning from user interactions to improve service quality over time (Kulal et al., 2024). However, the dual nature of AI and its potential to both enhance and undermine efficiency and accountability if poorly managed, highlights the importance of perceived reliability and trustworthiness in the adoption process. When users perceive AI systems as tools that genuinely improve operational efficiency and uphold accountability standards, they are more likely to view these technologies as useful and valuable within public services. Hence, we propose the following hypothesis:

Hypothesis H1. *Perceptions of efficiency and accountability positively influence perceived usefulness of AI chatbots in public administration services.*

Leadership and Motivation (LaM)

Leadership support is essential to achieve digital transformation and facilitate the dynamics of AI chatbots in public administration (Trottier et al., 2008). Effective leadership and motivation are selected as external factors because they directly impact employee engagement, trust in technology, and willingness to adopt AI tools. In developing countries particularly in Uzbekistan, leadership support can moderate resistance to change and ensure smooth integration of AI chatbots into traditional bureaucratic workflows. Leadership-led training and development programmes will be important because they can equip public sector employees with the necessary skills to work effectively with smart digital technologies and tools, thereby improving the efficiency of public administration services (Adam et al., 2021). From a motivational perspective, Maslow's hierarchy of needs emphasises that fulfilling higher-level needs, such as esteem and self-actualisation, can significantly enhance individual productivity, satisfaction, and willingness to engage with new opportunities (Ryan & Deci, 2000). The motivation for using smart technologies is that employees easily accept it as a useful tool. Additionally, leadership that supports technological adaptation increases trust in new technological processes, and as a result, the usefulness of intelligent systems adoption among employees increases. Hence, we propose the following hypothesis:

Hypothesis H2. *Leadership support and staff motivation positively influence perceived usefulness of AI chatbots in public administration services.*

Clear Strategy and Mindset Change (CSMC)

Effective adoption of AI chatbots requires a clear strategy, approach, with clear goals, objectives, and expected outcomes (Thierer et al., 2017). Such a strategy can set out specific actions, implementation roadmaps, and actively engage citizens by aligning AI initiatives with their needs. Since AI is a complex technology that influences multiple dimensions of governance, its adoption demands careful coordination across technical, organisational, and public aspects (White, 2017). Clear AI strategy and mindset change are included as external factors because they directly influence users' perceived ease of use by guiding implementation and fostering openness to innovation. In developing nations including Uzbekistan, where bureaucratic inertia is common, a clear

strategic plan ensures smoother integration and reduces resistance. Mindset change is a crucial factor because employee attitudes toward change significantly affect the success of technological initiatives. Individuals with a growth mindset are those who believe abilities can be developed through learning and effort are more likely to adapt to AI innovations (Labadze et al., 2023). Equally, a fixed mindset of users of public services can create resistance, slow adoption, and hinder the perceived ease of using new technologies in public administration. Thus, a clear AI strategy, and a growth-oriented mindset facilitate smoother adoption, improve perceived ease of use, and foster positive attitudes. Hence, we propose the following hypothesis:

Hypothesis H3. *A clear AI strategy and organisational mindset-change positively influence the perceived ease of use of AI chatbots in public administration services.*

Ethical AI Regulation and Adoption (EARA)

Ethical guidelines and regulatory frameworks guide responsible AI development, mitigate biases, and build trust (Goralski & Tan, 2020). Ethical AI regulation is emphasised because public trust is crucial for technology adoption, especially in developing countries. In Uzbekistan, clear regulations and its effective implementation help users perceive AI chatbots as safe, reliable, and compliant with legal and ethical standards. This factor was specifically chosen to address potential concerns about bias, privacy, and misuse. However, the implementation and sustainable integration of AI chatbots requires adherence to ethical standards, regulatory frameworks, and privacy protections. Without clear ethical and regulatory guidelines, AI chatbots risk perpetuating biases, reducing transparency, and undermining citizen trust (Dasgupta & Wendler, 2019). Responsible AI should not only include its potential to improve service delivery, but also ensure that these technologies operate within boundaries that protect citizens' rights and uphold democratic values (Androutsopoulou et al., 2019). Establishing strong ethical and legal frameworks builds public trust, a key driver for widespread acceptance of AI in governance (Reis et al., 2019). In this context, ethical AI regulation not only ensures responsible usage but also plays a significant impact in shaping public employees' and citizens' perspectives of the ease-of-use AI chatbots. When regulations are perceived as fair and transparent, users view AI systems, particularly AI chatbots, as more accessible, and trustworthy. Hence, we present the following hypothesis:

Hypothesis H4. *Ethical AI regulation and adoption positively impacts perceived ease of use of AI chatbots in public administration services.*

Data Management and Security (DMS)

Strong data governance, security measures, and privacy protections are vital for AI systems, chatbots credibility (Chen et al., 2021). Data management and security are involved as external factors because trust in AI tools is contingent on the reliable handling of sensitive information. In Uzbekistan, where cybersecurity frameworks are developing, strong data management can influence both attitudes and behavioural intentions toward AI adoption. Governments must establish comprehensive data management frameworks to ensure data quality, safeguard sensitive information, and maintain compliance with relevant data protection regulations (Bertino, 2016). Strong data protection policies against cybersecurity threats not only protect citizens' data but also build trust in digital systems. Digital technologies can help public sec-

tor organisations implement effective data management practices while minimising the risks associated with misuse (Chatterjee & Chaudhuri, 2022). Reliable and secure AI chatbots enhances users' perceptions of AI system integrity. Effective data management and security will increase users' trust in artificial intelligence chatbots, which will increase their chances of using these technologies in daily operations. When users trust data security, their attitudes toward using AI tools become more positive. Thus, we propose the following hypothesis:

Hypothesis H5. *Effective data management and security positively influence users' attitudes toward using AI chatbots in public administration services.*

Perceived Ease of Use (PEU)

According to TAM, PEU indicates the degree to which an individual believes that using technology does not require much effort, while PU reflects the degree to which technology is adopted to improve productivity (Davis, 1989). In this study, PEU and PU relationships are considered alongside the above external factors to create a more comprehensive and contextually relevant adoption model. Analysing the opinions of users of AI tools in public administration services is particularly important in this process (Venkatesh & Davis, 2000). Furthermore, in a public sector environment with restrictive and complex bureaucratic procedures, perceived value can also be significantly increased by streamlining business processes, increasing access to services, and facilitating citizen participation. Hence, we propose the following hypothesis:

Hypothesis H6. *Perceived ease of use positively influences the perceived usefulness of AI chatbots in public administration services.*

Perceived Usefulness (PU)

PU has been extensively recognised as a critical factor of an individual's attitude toward use of AI-powered chatbots. When users perceive a technology as useful, meaning it enhances their performance, and effectiveness, they are more likely to develop a favourable attitude toward its use (Davis, 1989). When users perceive that chatbots or others virtual assistants facilitate better task management, decision-making, and citizen engagement, they are more inclined to form positive attitudes toward using these AI based technologies (Gefen & Straub, 2000). Furthermore, a strong perception of usefulness increases users' motivation and drive to use AI technology. Therefore, the more users know about the practical benefits of AI chatbots, the more likely they are to use them and develop a positive attitude.

Hypothesis H7. *Perceived usefulness positively influences the attitude toward using AI chatbots in public administration services.*

Perceived Ease of Use to Attitude Toward using (PEU – AT)

Perceived ease of use directly influences the attitude of users towards the adoption of new technology (Venkatesh et al., 2012) When users find chatbots easy to understand and operate, they develop a positive attitude towards using them. Ease of use not only reduces users' cognitive and operational burdens, but also increases their awareness of the system's capabilities, which in turn encourages them to engage with them. Similarly, when systems are perceived as complex, users develop more negative attitudes, which leads

to resistance and reduces their intention to use these AI tools. Previous research shows that user-friendly interfaces and seamless communication channels increase user trust, readiness, and adoption of AI (Gefen & Straub, 2000). Therefore, ensuring that AI-powered chatbots are perceived as easy to use is essential for fostering positive user attitudes and promoting effective adoption in public sector organisations. Thus, we hypothesise:

Hypothesis H8. *Perceived ease of use positively influences attitude toward using AI chatbots in public administration services.*

Perceived Usefulness to Behavioural Intention (PU – BI)

As suggested by the extended TAM model, the usage behaviour of AI chatbots is significantly shaped by PU (Venkatesh et al., 2003). When users find AI chatbots helpful in improving efficiency and service quality, they are more likely to use them in their tasks. Research on AI chatbots has shown that users' intentions to continue using these technologies are largely driven by benefits such as convenience, ease of use, and faster service (Chatterjee & Chaudhuri, 2022). These technologies perceived as highly useful reduce operational barriers, enhance users' satisfaction, and increase their readiness to integrate AI into daily workflows. Moreover, perceived usefulness does not only impact initial adoption but also plays a vital role in sustaining long-term engagement with AI-powered chatbots. Recognising tangible advantages in the context of public service innovation motivates users to advocate for and expand the use of AI solutions within their organisations.

Hypothesis H9. *Perceived usefulness positively influences behavioural intention to use AI chatbots in public administration services.*

Attitudes Toward Use to Behaviour Intention

Positive attitudes toward the use of AI chatbots through trust and satisfaction, influence behaviour toward the use of these technologies. Therefore, an increase in positive attitudes towards use positively affect a user's thoughts and behaviour regarding the use of AI chatbots. In addition, positive attitudes toward the use of AI chatbots increase users' intention to use chatbots in public administration services (Venkatesh et al., 2012). Previous studies also have shown that if users are satisfied with AI chatbots, they are more likely to adopt these technologies in practice. Moreover, a positive attitude enhances users' emotional readiness and builds confidence in the potential of AI to improve public sector efficiency, transparency, and service quality. Therefore, cultivating favourable attitudes is essential not only for encouraging initial acceptance but also for supporting the long-term integration of AI in public administration services. Based on these considerations, we hypothesise:

Hypothesis H10. *Attitude towards using AI positively influences behavioural intention to use chatbots in public administration services.*

Methodology and conceptual model

Data collection and sampling

Data for this study were collected through a structured online survey designed to assess government employees' perceptions of AI chatbot adoption in Uzbekistan's public service delivery. A purposive sampling strategy was employed to ensure that

only respondents with relevant experience in public sector digitalisation initiatives were included in the study. The target population consisted of public sector employees involved in digital transformation processes across ministries and government agencies. Respondents included policy specialists, IT and digitalisation officers, and administrative staff engaged in services delivery modernisation. Geographically, the sample covered both central government institutions in Tashkent and regional administrative offices across Uzbekistan. The data collection was conducted between August and December 2025 using an online survey platform (Google Forms). The questionnaire was distributed via official institutional email channels and professional networks. A total of 510 questionnaires were distributed, of which 507 valid responses were obtained, resulting in a response rate of approximately 99.4%. To ensure data quality, several screening procedures were applied. Responses were checked for straight-lining, inconsistent response patterns, and unusually short completion times. After removing low-quality and incomplete responses, the final dataset consisted of 507 valid observations, which were used for further statistical analysis. The survey instrument was administered in both English and Uzbek to ensure clarity and accessibility for respondents. All measurement items were adapted from established literature and tailored to the context of AI chatbot adoption in public administration. The questionnaire included core Technology Acceptance Model (TAM) constructs, extended with context-specific variables such as efficiency, accountability, leadership, motivation, strategic clarity, mindset change, ethical AI governance, and data management and security (Dasgupta & Wendler, 2019).

Measurement scale

All constructs in this study were measured using validated scales adapted from prior Technology Acceptance Model (TAM) research and contextualised for AI chatbot adoption in public sector services. The final questionnaire consisted of nineteen (19) items measured on a seven-point Likert scale ranging from 1 (“strongly disagree”) to 7 (“strongly agree”) (Scheuren, 2004). Each construct was operationalised using at least two reflective indicators, which is acceptable for Partial Least Squares Structural Equation Modelling (PLS-SEM), particularly in exploratory and prediction-oriented research contexts, although the use of three or more indicators is generally recommended. To ensure content validity, the initial questionnaire was reviewed by two experts in digital governance and artificial intelligence in the public sector. Based on their feedback, four items were removed and several were refined for clarity and contextual relevance, resulting in the final 19-item instrument (see Appendix, Table A1). Minor wording adjustments were made to align the instrument with the institutional and linguistic context of Uzbekistan’s public administration systems. Ethical considerations were strictly followed throughout the research process. Participation was voluntary, informed consent was obtained from all respondents, and anonymity and confidentiality were fully ensured. No personally identifiable information was collected.

Data analysis techniques

This study employed Partial Least Squares Structural Equation Modelling (PLS-SEM) using source: SmartPLS 4 software to examine the relationships among constructs and test the proposed hypotheses. PLS-SEM was chosen due

to its suitability for complex models, its robustness with medium sample sizes, and its predictive-oriented nature, making it appropriate for analysing AI adoption behavior in a developing country context (Hair et al., 2019). The analysis followed a two-step approach. First, the measurement model was assessed to evaluate reliability and validity. Internal consistency reliability was examined using Cronbach’s alpha and composite reliability (CR). Convergent validity was assessed through average variance extracted (AVE) and indicator loadings (Fornell & Larcker, 1981). Discriminant validity was confirmed using the Fornell–Larcker criterion and cross-loadings. To ensure robustness and address potential common method bias, full collinearity variance inflation factor (VIF) values were examined following Kock (2015). All VIF values were below the recommended threshold, indicating no serious multicollinearity or common method bias concerns. Second, the structural model was evaluated using path coefficients, coefficient of determination (R^2), and effect sizes (f^2), following established guidelines (Hair et al., 2012). This approach provides robust empirical evidence on the determinants of AI chatbot adoption in Uzbekistan’s public administration.

Results

Demographics and data screening

Prior to the main analysis, the raw dataset ($n = 507$) was subjected to a rigorous data screening process to ensure data integrity. An assessment of missing values revealed that less than 1% of the data were missing; these values were handled using mean citation. The results indicated that no extreme observations were present that could threaten the normality or reliability of the dataset. Table 2 shows the demographics of respondents of this study. The overall percentages by gender were 69.9% male and 30.1% females. Regarding the age level, respondents were 18–25 years old – 23.8%, 26–45 years old – 49.9%, and over 46 years old – 26.3%. Regarding the level of education, respondents had undergraduate degree of 30.1%, graduate (masters) degree of 58.3%, and a Ph.D. degree and others 11.6%. Turning to years of experiences were 0–5 years 24.4%, 6–10 years 47.3%, and more than 11 years of work experience 28.3%. All respondents were voluntary participants.

Table 2

Sample characteristics

Characteristics	Frequency ($n=507$)	Percentage (%)
<i>Gender</i>		
Male	355	69.90
Female	152	30.10
<i>Age</i>		
18–25 years	123	23.80
26–45 years	246	49.90
Over 46 years	138	26.30

Characteristics	Frequency (<i>n</i> =507)	Percentage (%)
Level of Education		
Undergraduate	153	30.10
Graduate (Masters)	296	58.30
PhD and others	58	11.60
Year of Experiences		
0–5	124	24.40
6–10	239	47.30
Over 11 years	144	28.30

Source: SmartPLS, developed by the authors.

Measurement model

This model is an important for diagnosis of data health for further analysis. Prior to analysing the structural relationships, the measurement model's validity and reliability were assessed to ensure the robustness of the results. PLS-SEM was used to confirm the constancy and accuracy of constraints for examination of relationships between variables within a structural model and testing hypotheses. It scores for 500 iterations and to confirm the accuracy of the relationships, the measurement model was tested for reliability and validity using 5,000 bootstrap subsamples with 95 percent self-confidence intermission, two tailed and significance level of 5 percent, as suggested by Hair et al. (2019). We used two major tests, reliability and validity in this study.

(1) For the reliability of the items, all external loadings exceeded the 0.70 threshold. Cronbach's Alpha (C.A) and Composite Reliability (C.R) values ranged from 0.655 to 0.915, confirming strong internal consistency. If the external loading values are significant, cut-off values of 0.7 and 0.6 are accepted (Ursachi et al., 2015). Accordingly, as can be seen from Table 3 of reliability and validity values, all constructs have composite reliability and Cronbach's alpha value is greater than the cut-off value. This indicates that the reliability levels of the data are fully met and the data are reliable for further analysis. All items positively supported level of estimation. The results of Cronbach's alpha and CR presented the cut off threshold value between 0.6 and 0.7 (Hair et al., 2019). The results showed that the convergent validity was acceptable.

(2) For the validity of the items, the study used convergent and discriminant validity. For the convergent validity, Average Variance Extracts (AVE) was used, its values should be above 0.5 for each construct. In this study, the table presented below of the reliability and validity shows all constructs for AVE values have a greater than cut off threshold value of 0.5 (Fornell & Larcker, 1981), which shows all constructs are convergently valid. For discriminant validity, the Fornell-Larker criteria, and the cross-loadings are used in this study. Table 4 of the Fornell-Larker criteria shows that all the bold corresponding constructs (row and pillars) values are significant than threshold standards. The discriminant validity is considered acceptable if the

square root of the AVE is greater than the above values of the square root of the corresponding correlation (Rönkkö & Cho, 2022). To estimate cross loadings, each indicators' loading should be higher than its conforming variables' indicators. The results show that indicator items measuring each construct were significantly linked with each other and greater loadings on their concepts. Based on these, major values of discriminant validity were established and the cross-loading's criterion is satisfied. The results specify all the square root of the AVE is greater than conforming squared relationship. Thus, this measurement model confirms acceptable discriminant validity. The above measurement analysis offers solid indication for reliability and validity based on convergent and discriminate of the developed model in this research.

Table 3

Reliability and validity results

Constructs	Factor loadings	C.A	C.R	AVE
Efficiency and Accountability				
EaA1	0.844	0.672	0.858	0.752
EaA2	0.889			
Leadership and Motivation				
LaM1	0.911	0.779	0.900	0.819
LaM2	0.899			
Clear Strategy and Mindset-Change				
CSMC1	0.862	0.657	0.854	0.745
CSMC2	0.864			
Ethical AI Regulation and Adoption				
EARA1	0.867	0.692	0.867	0.765
EARA2	0.881			
Data Management and Security				
DMS1	0.916	0.732	0.880	0.786
DMS2	0.856			
Perceived Usefulness				
PU1	0.855	0.655	0.853	0.744
PU2	0.869			
Perceived Ease of Use				
PEU1	0.885	0.733	0.882	0.789
PEU2	0.892			
Attitude Toward using				
AT1	0.886	0.780	0.900	0.818
AT2	0.923			

Constructs	Factor loadings	C.A	C.R	AVE
<i>Behavioural Intention to use</i>				
BI1	0.865	0.861	0.915	0.783
BI2	0.900			
BI3	0.888			

Note: *Cronbach's Alpha (C.A), Composite Reliability (C.R), Average Variance Extracts (AVE).

Source: SmartPLS, developed by the authors.

Table 4

Discriminant validity for the Fornell-Larcker criterion

	AT	BI	CSMC	DMS	EARA	EaA	LaM	PEU	PU
AT	0.905								
BI	0.664	0.885							
CSMC	0.661	0.727	0.863						
DMS	0.809	0.787	0.687	0.887					
EARA	0.699	0.666	0.767	0.749	0.874				
EaA	0.735	0.678	0.706	0.744	0.796	0.867			
LaM	0.585	0.738	0.752	0.689	0.695	0.648	0.905		
PEU	0.767	0.666	0.696	0.753	0.729	0.706	0.732	0.888	
PU	0.721	0.722	0.807	0.766	0.855	0.773	0.716	0.774	0.862

Note: AT – attitude; BI – behavioural intention; CSMC – clear strategy and mindset-change; DMS – data management and security; EARA – ethical AI regulation and adoption; EaA – efficiency and accountability; LaM – leadership and motivation; PEU – perceived ease of use; PU – perceived usefulness.

Source: SmartPLS, developed by the authors.

Table 5

Cross loading results

	AT	BI	CSMC	DMS	EARA	EaA	LaM	PEU	PU
AT1	0.886	0.507	0.587	0.650	0.621	0.651	0.548	0.693	0.643
AT2	0.923	0.680	0.609	0.801	0.643	0.679	0.515	0.696	0.662
BI1	0.642	0.865	0.616	0.751	0.608	0.670	0.646	0.602	0.672
BI2	0.575	0.900	0.645	0.662	0.585	0.547	0.673	0.588	0.609
BI3	0.536	0.888	0.668	0.667	0.571	0.574	0.639	0.576	0.630
CSMC1	0.534	0.571	0.862	0.611	0.764	0.638	0.652	0.599	0.728
CSMC2	0.607	0.683	0.864	0.574	0.561	0.581	0.645	0.602	0.664
DMS1	0.799	0.637	0.580	0.916	0.659	0.675	0.518	0.687	0.687
DMS2	0.618	0.781	0.652	0.856	0.677	0.646	0.737	0.648	0.674
EARA1	0.573	0.632	0.693	0.658	0.867	0.704	0.591	0.621	0.855
EARA2	0.647	0.536	0.650	0.652	0.881	0.689	0.623	0.654	0.646

	AT	BI	CSMC	DMS	EARA	EaA	LaM	PEU	PU
EaA1	0.563	0.582	0.534	0.626	0.632	0.844	0.474	0.526	0.615
EaA2	0.703	0.595	0.681	0.664	0.742	0.889	0.638	0.688	0.720
LaM1	0.530	0.684	0.684	0.635	0.664	0.607	0.911	0.649	0.667
LaM2	0.529	0.651	0.677	0.613	0.592	0.564	0.899	0.677	0.629
PEU1	0.651	0.620	0.611	0.684	0.632	0.610	0.662	0.885	0.700
PEU2	0.710	0.564	0.625	0.654	0.663	0.645	0.638	0.892	0.675
PU1	0.573	0.632	0.693	0.658	0.867	0.704	0.591	0.621	0.855
PU2	0.669	0.614	0.698	0.663	0.614	0.631	0.643	0.712	0.869

Note: Bold characters indicate the loading of each consistent variable.

Source: SmartPLS, developed by the authors.

Structural model results

The structural model explains the inter-construct relations of the research model. Figure 2 presents the structural model, describing the assessed regression path coefficients (β) and their conforming meaning between the hypotheses and indicator items of the outer loadings with their significance points.

Collinearity and Method Bias

In terms of range model, PLS-SEM examines for each item the presented full collinearity assessment based on variance inflation factors (VIF) (Kock, 2015). The VIF value should be small or equal to 10. Table 6 shows that all the concepts have VIF standards less than 10, demonstrating no collinearity problem in the model. According to the VIF test rule, if the VIF values of the full collinearity test are equal to or less than 3.3, the model is judged to be significant. The VIF values of the study also showed less than 3.3. This means that the study model is free from uncertainties.

Table 6

Collinearity statistics (VIF)

	AT	BI	CSMC	DMS	EARA	EaA	LaM	PEU	PU
AT		2.084							
BI									
CSMC								2.430	
DMS	2.860								
EARA								2.430	
EaA									2.154
LaM									2.322
PEU	2.949								2.691
PU	3.087	2.084							

Source: SmartPLS, developed by the authors.

As shown in Figure 2, the outcomes of R^2 presented are $PU=72.0\%$, $PEU=57.7\%$, $AT=71.4\%$, and $BI=56.4\%$. Based on an examination of Figure 2, Tables 7 describes path coefficients (β) and p-values respectively for the hypotheses.

Table 7 presents the summary of hypothesis testing results. According to path analysis, nine hypotheses were fully supported, while one was not supported, indicating that most paths between dependent and independent variables are statistically significant. H1 – perceptions of efficiency and accountability have a positive impact on the perceived usefulness of AI chatbots in public administration services ($\beta = 0.397$, $t = 8.439$, $p < 0.001$). H2 – the leadership support and staff motivation have a positive impact on perceived usefulness ($\beta = 0.212$, $t = 3.376$, $p < 0.001$). H3 – clear AI strategy and organisational mindset-change had a confident effect on the perceived ease of use ($\beta = 0.332$, $t = 4.910$, $p < 0.001$). H4 – ethical AI regulation and adoption had a positive impact on perceived ease of use ($\beta = 0.474$, $t = 7.248$, $p < 0.001$). H5 – data management and security practices had a positive impact on users' attitudes towards use ($\beta = 0.495$, $t = 9.101$, $p < 0.001$). H6 – perceived ease of use positively had a positive impact on perceived usefulness ($\beta = 0.338$, $t = 4.773$, $p < 0.001$). H7 – perceived usefulness did not have a statistically significant effect on attitude toward use ($\beta = 0.093$, $t = 1.711$, $p = 0.087$). H8 – perceived ease of use had a positive impact on attitude towards use ($\beta = 0.322$, $t = 4.666$, $p < 0.001$). H9 – perceived usefulness positively influenced behavioural intention to use ($\beta = 0.508$, $t = 7.823$, $p < 0.001$). H10 – attitude toward use positively affected behavioural intention to use AI chatbots in public administration services ($\beta = 0.297$, $t = 4.227$, $p < 0.001$).

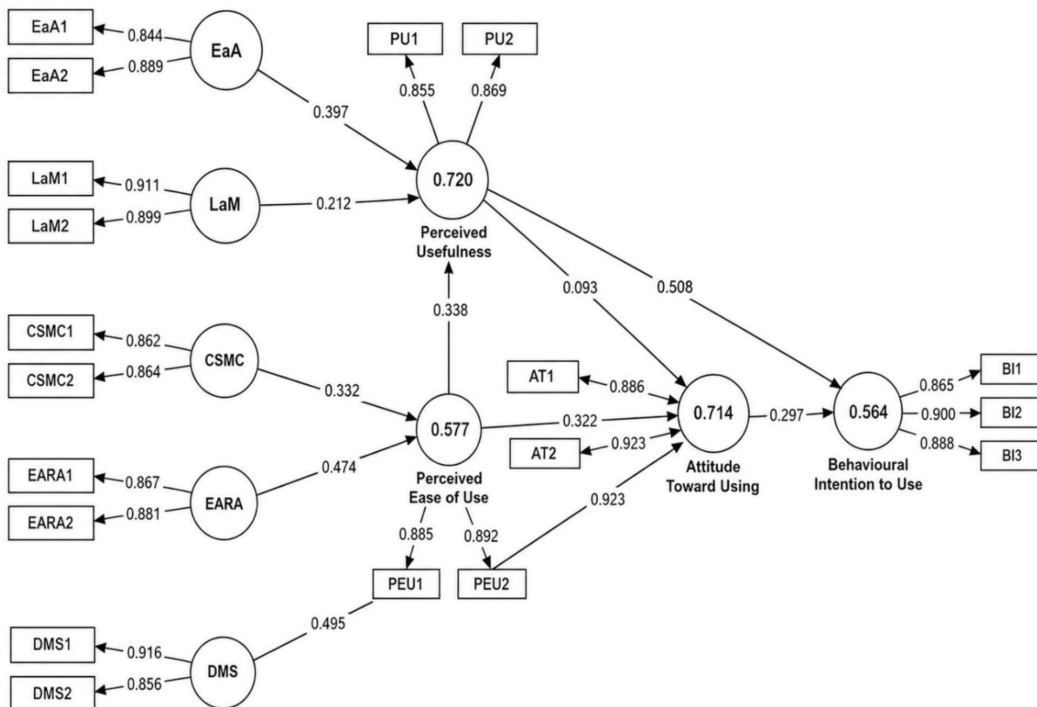


Figure 2. Results of the Structural Model

Source: SmartPLS, developed by the authors.

Table 7

Results of hypothesis testing

Hypothesis	Path	Path coefficient	Sample mean	Standard deviation	T-statistics	P-values	Results
H1	EaA → PU	0.397	0.395	0.047	8.439	0.001	YES
H2	LaM → PU	0.212	0.215	0.063	3.376	0.001	YES
H3	CSMC → PEU	0.332	0.333	0.068	4.910	0.001	YES
H4	EARA → PEU	0.474	0.473	0.065	7.248	0.001	YES
H5	DMS → AT	0.495	0.495	0.054	9.101	0.001	YES
H6	PEU → PU	0.338	0.337	0.071	4.773	0.001	YES
H7	PU → AT	0.093	0.097	0.054	1.711	0.087	NOT
H8	PEU → AT	0.322	0.319	0.069	4.666	0.001	YES
H9	PU → BI	0.508	0.508	0.065	7.823	0.001	YES
H10	AT → BI	0.297	0.297	0.070	4.227	0.001	YES

Notes: *Path coefficients are significant on $p < 0.01$, $p < 0.001$.

Source: SmartPLS, developed by the authors.

Results of direct, indirect and total effects

Additionally, to prove the significance of the mediating effects, we proved the mediating effects of using PLS presented in Table 8. The results confirm that, EaA directly influenced PU ($\beta=0.397$, $p < 0.001$); LaM directly influenced PU ($\beta=0.212$, $p < 0.001$); CSMC directly influenced PEU ($\beta=0.332$, $p < 0.001$); EARA also directly influenced PEU ($\beta=0.474$, $p < 0.001$); DMS directly influenced AT ($\beta=0.495$, $p < 0.001$), next PEU directly effects PU ($\beta=0.338$, $p < 0.001$); PU had a non-significant effect on AT ($\beta = 0.093$, $t = 1.711$, $p = 0.087$); AT directly affected BI ($\beta = 0.297$, $t = 4.227$, $p < 0.001$), highlighting its significance for AI chatbot adoption in public administration services. Moreover, PEU indirectly influenced AT ($\beta=0.032$, $p < 0.001$); and PU indirectly affected BI ($\beta=0.028$, $p < 0.001$), which indirectly contribute intention for enhancing of public administration services. Therefore, the results indicate a significant of these factors such as efficiency and accountability, leadership support and motivation, clear strategy and mindset- change, ethically AI regulation and adoption, data management and security in adoption of AI chatbots in public administration services efficiency.

Table 8

Results of estimation

Path coefficients	Direct effects	Indirect effects	Total effects
EaA → PU	0.397	0	0.397*
LaM → PU	0.212	0	0.212*
CSMC → PEU	0.332	0	0.332*
EARA → PEU	0.474	0	0.474*

Path coefficients	Direct effects	Indirect effects	Total effects
DMS → AT	0.495	0	0.495*
PEU → PU	0.338	0	0.338*
PU → AT	0.093	0	0.093
PEU → AT	0	0.032	0.032*
PU → BI	0	0.028	0.028*
AT → BI	0.297	0	0.297*

Note: * $p < 0.001$.

Source: SmartPLS, developed by the authors.

Discussion

Interpretation of main findings

In examining the determinants of AI chatbot adoption in public administration services in the context of a developing country, this study makes a valuable contribution to the field of AI chatbot integration. First, the results of our study are in line with the two leading studies (Kulal et al., 2024) and (Engin & Treleaven, 2019). These scholars showed the value of AI based technologies and their adoption, impacts and efficiency in several examinations, which are also components of the public sector, digital governance, and public administration services in developing countries' contexts. Our findings highlight the significant role of AI chatbot adoption in enhancing public service delivery and demonstrate the opportunities that intelligent systems provide for improving public administration services. These results are consistent with previous research by Madan and Ashok (2023). The results of this study support Hypotheses H1, H2, H3, and H4, confirming the proposed relationships among the constructs. As specified in this existing works (Adam et al, 2021), the role of AI chatbots adoption on digital governance and algorithmic government is important to support public servants and provide services to citizens. AI-enabled systems have a positive influence on public administration services (Engin & Treleaven, 2019). The study also showed learned leadership and motivation, data management and security in public administration services. Previous studies have examined the impact and opportunities of smart digital technologies on improving public services and the efficiency of public services delivery (Radhakrishnan & Chattopadhyay, 2020), and the study investigates the specific tool of AI in the context of a developing country, namely Uzbekistan. The findings led to the acceptance of our H2 and H5 developed in this study. These results indicate that AI chatbots are viewed not just as technical instruments but as governance tools capable of transforming accountability and service provision in evolving public sector organisations. In Uzbekistan's new public administration services, gains in efficiency and accountability, clear strategy and mindset-change, ethical AI regulation and adoption, data management and security are especially valued because of continuous strategic reforms and digital government efforts to minimise bureaucratic inefficiencies in public sector organisations.

Second, the research results confirm the applicability of the TAM model in the case of a developing country, here Uzbekistan, indicating that the perceived ease of use and perceived usefulness are key determinants of users' attitudes and behaviour towards the adoption of AI chatbots in public administration. The TAM based method has recently attracted recognition from new scholars (Hair et al., 2019). The significant influence in AT factors underscores the role of behavioural intention to use influences in shaping technology acceptance in public sector. Additionally, external factors H1 to H4 (efficiency and accountability, leadership and motivation, clear AI strategy and mindset-change, ethical AI regulation and adoption) play vital roles in shaping perceptions of usefulness and ease of use, thus affecting adoption intentions. Hypothesis H5, data management and security shows a positive impact on AT. Hypothesis H6, PEU positively impacts PU. The significant impact of external organisational factors on perceived ease of use and perceived usefulness suggests that technology adoption in public administration system is greatly influenced by institutional support rather than solely by individual tech skills. This contrasts with numerous studies in developed nations, where personal innovativeness and technological knowledge frequently have a greater impact. However, the relationship between perceived usefulness and attitude (H7) was found to be statistically insignificant. This suggests that in the Uzbek public administration context, AI chatbots are perceived less as optional productivity-enhancing tools and more as mandated or policy-driven instruments. Institutional constraints, limited autonomy in technology choice, and concerns regarding accountability and job security may weaken the direct motivational effect of perceived usefulness on attitudes. This finding contrasts with evidence from developed countries, where perceived usefulness is typically a strong predictor of user attitudes, highlighting the importance of contextual and institutional factors in technology acceptance (Setayesh & Daryaei, 2017; Taheri et al., 2020). Furthermore, hypotheses H8, H9, H10 indicate that the perceived ease of use positively influences attitude toward use, perceived usefulness positively affects behavioural intention to use, and attitude towards the use positively influences behavioural intention to the use of AI chatbots in public administration services. Overall, these factors are important for the effective adoption and integration of AI chatbots in public administration systems.

Third, the study's integrated and extended TAM-based model examines the key factors of intelligent systems adoption and the factors that influence users' acceptance and usage intentions of AI tools. According to previous studies, adoption of AI chatbots promotes the automation of routine administrative procedures, the redesign of government processes, and the freeing up of staff resources which ultimately leads to higher productivity and improved citizen interaction (Thierer et al., 2017). Also, the dual nature of AI and its potential to both enhance and undermine efficiency and accountability if poorly managed highlights the importance of perceived reliability and trustworthiness in the adoption process (Gulyamov et al., 2023). The findings confirm that most of the hypotheses developed are indicative of the positive and significant influences of efficiency and accountability, leadership and motivation, clear strategy and mindset-change, ethical AI regulation and implementation, and data management and security on the behavioural intention in the

effective adoption of AI chatbots in public administration services. In the context of Uzbek public administration services, effective leadership is crucial because of hierarchical decision-making processes, where approval from higher management is frequently necessary for effective adopting technology. This strengthens the idea that leadership and motivation are more significant factors in AI adoption in developing nations compared to decentralised administrative frameworks. And also, it is significantly influencing users' behavioural intention towards use of AI-powered chatbots in their duties (Chong et al., 2021). The strong leadership is essential for achieving digital transformation and facilitating the dynamic adoption of smart technologies within public administration systems. The results of this study exhibited that leadership and motivation show significantly impact to perceived usefulness on AI chatbots in public administration services. According to previous investigations, the successful adoption of digital technologies in government organisations requires the establishment of a clear and well-defined strategy with specific goals, objectives, and expected outcomes. And also, mindset-change is crucial because employee attitudes toward change significantly affect the success of technological initiatives (Adam et al., 2021). The results of our study confirmed that all of aforementioned factors had a significant and positive impact on the adoption of AI chatbots in new public administration services.

Theoretical implications

This study validates the TAM model framework, broadens the scope of effective adoption of AI chatbots in public administration in developing countries, and strengthens its robustness in diverse socio-economic contexts. The model's results in capturing key determinants suggest that core constructs such as usability and usefulness remain relevant, although their externalities (e.g., effectiveness and accountability, leadership and motivation, clear strategy and mindset-change, ethical regulation and acceptance of AI, and data governance and security) are relevant to the context of developing countries. The study also highlights the importance of integrating organisational and ethical factors into an international framework to better understand the adoption of AI technology in public administration systems and examines the theoretical richness of the model. The study delivers significant contribution by applying the TAM based model which identified the determinants influencing user acceptance and usage intentions of AI-powered tools for policymakers to achieve positive outcomes when adopting AI chatbots in new public administration services. The findings suggest that policymakers should integrate AI chatbot adoption into national digital government strategies by providing clear implementation guidelines, ethical standards, and performance metrics. Government entities ought to allocate resources to leadership training initiatives that focus on digital skills and change digital management, since leadership support has proven to be a vital factor in adoption. Public organisations need to focus on robust data infrastructure and clear data governance systems to tackle employee worries about privacy and responsibility (Thierer et al., 2017). Implementing pilot AI-based chatbot initiatives in selected ministries, along with organised feedback systems from public employees, can foster trust and progressively enhance perceptions of AI-enabled service delivery.

Practical implications

Practitioners aiming to encourage the adoption of AI chatbots should focus on making them easier to use by designing user-friendly interfaces, changing mind-sets, and providing targeted training. Highlighting the usefulness of chatbots by demonstrating the increased efficiency and accountability, leadership and motivation, data governance, and privacy protection will positively influence user attitudes and intentions. Developing clear AI strategies, frameworks and promoting the ethical regulation of AI applications are essential for building trust and addressing ethical issues, which will further facilitate adoption. Integrating technological, organisational, and ethical aspects into strategic planning plays a critical role in the successful integration of AI into public administration services. These critical factors should also be considered when effectively implementing AI chatbots in today's public administration services operations. Indeed, the results of this study in the social sciences confirm the importance of integrating new technological initiatives, tools, and tools in the public and private sectors. Overall, these findings demonstrate the theoretical and practical importance of adopting AI chatbots in public administration services, notably in the context of other developing countries.

Limitations and directions for future research

While this study provides valuable insights, it has some limitations that need to be noted. First, it is limited to the specific context of Uzbekistan and relies on survey data from a single country. Future research needs to assess and examine changes over time. The inclusion of this work in developing countries helps to generalise findings and identify context-specific factors. In addition, the use of models such as the Technology–Organisation–Environment (TOE) framework, and the Unified Theory of Adoption and Use of Technology (UTAUT) can enrich the multifaceted nature of AI chatbot adoption in the public sector. We also believe that it is important to examine the impact of cultural dimensions, organisational readiness, and technological infrastructure on AI adoption from the perspective of developing a broader framework in this area. Future studies should use mixed-method approaches to investigate the underlying institutional and cultural reasons for surprising results, especially the minimal impact of perceived usefulness. Comparative analyses of developing and developed nations would enhance understanding of how administrative culture and governance frameworks affect AI chatbot adoption in public administration services.

Conclusions

Currently, the adoption of digital technologies, in particular, AI-chatbots are attracting higher attention as useful digital smart technologies to contribute to efficiency, productivity, effective analysis of big data, and digitalisation of services in various sectors. The increasing interest is thoroughly verified in both information systems and prominent public administration literature, including in prestigious journals. This study makes a significant contribution to the scientific understanding of the adoption of AI-chatbots in the context of a developing country, particularly the public administration service of Uzbekistan. By clearly introduction the

analysis in a developing country's administrative framework, the research broadens current public administration service studies that have mainly concentrated on developed countries. By empirically validating the applicability of the TAM model, the results highlight the critical roles of perceived ease of use, perceived usefulness and public influence in shaping user acceptance and behavioural intentions. Furthermore, it highlights the importance of addressing broader organisational and ethical factors such as efficiency and accountability, leadership and motivation, clear strategy and mindset-change, ethical AI regulation and adoption, and data management and security that directly impact perceptions and facilitate effective adoption process. Subtle insights into the indirect effects of leadership support and motivation confirm the multifaceted nature of successful AI integration.

Finally, the effective use of smart digital technologies, particularly AI-chatbots, in government services requires a holistic approach that combines technological usability, administrative readiness, and ethical safeguards. Practitioners should prioritise designing user-friendly interfaces, articulating clear strategic visions, building trust, and ensuring strong ethical and data security for their use. From a governance perspective in Uzbekistan and other developing countries, this entails aligning AI chatbot initiatives with national digital government strategies, strengthening inter-agency collaboration, and allocating adequate resources for the training and capacity building of public officials. Ongoing research should continue to refine generally accepted theoretical models and explore the longitudinal effects of additional external factors and cross-cultural differences to support sustainable AI chatbot integration. Continuous evaluation of digital governance initiatives will benefit such comprehensive efforts and ensure that AI technologies effectively serve the interests of the state and the people while maintaining transparency and ethical standards.

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APPENDIX

Table A1

List of measurement items

Constructs	Items
<i>Efficiency and accountability (EaA)</i>	
EaA1	I am convinced that AI chatbots enable and enhance my efficiency and productivity
EaA2	AI chatbots encourage my accountability and transparency in task performance
<i>Leadership and motivation (LaM)</i>	
LaM1	I believe my leader supports the use of AI chatbots
LaM2	My leader looks for the most effective solutions to problems with AI
<i>Clear strategy and mindset-change (CSMC)</i>	
CSMC1	Clear strategy is a core for use of AI chatbots
CSMC2	I believe mindset-change is essential for using chatbots in government services
<i>Ethical AI regulation and adoption (EARA)</i>	
EARA1	Ethical regulations increase confidence for AI chatbots adoption
EARA2	I believe AI chatbots have more advantages than disadvantages in my job
<i>Data management and security (DMS)</i>	
DMS1	I trust chatbots to improve data management, my privacy and safety
DMS2	I choose to use AI chatbots to get easy public services
<i>Perceived usefulness (PU)</i>	
PU1	Using AI chatbots helps me to do tasks more efficiently
PU2	I believe chatbots help my engagement
<i>Perceived ease of use (PEU)</i>	
PEU1	I believe learning to use AI chatbots is not a challenge for me
PEU2	I trust AI chatbots to be user-friendly, requiring minimal effort to use
<i>Attitude toward using (AT)</i>	
AT1	I have a positive attitude toward the use of AI chatbots
AT2	I am confident that chatbots increase my satisfaction
<i>Behavioural Intention to use (BI)</i>	
BI1	I plan to use AI chatbots more often in my work
BI2	I propose to use AI chatbots in my daily tasks
BI3	I intend to use AI chatbots and virtual assistants to better utilise government services

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REVISITING THE ROLE OF SATISFACTION IN E-GOVERNMENT LOYALTY: EVIDENCE FROM A DIGITAL TRANSPORTATION PLATFORM IN INDONESIA

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Abstract. This study examines the direct and indirect effects of digital service quality, digital trust, perceived usefulness, and system quality on citizen satisfaction and loyalty among Access by KAI users on Java Island, while reassessing the mediating role of satisfaction in government-operated digital transportation platforms. A quantitative approach using Partial Least Squares Structural Equation Modelling (PLS-SEM) analysed responses from 324 purposively sampled users across six provinces in Java. Validated instruments were adapted from ESERVQUAL, Technology Acceptance Model (TAM), and the DeLone & McLean Information System Success Model. Perceived usefulness and system quality significantly influenced both citizen satisfaction and citizen loyalty. Digital service quality significantly affected satisfaction but not loyalty, while digital trust significantly affected loyalty but not satisfaction. Satisfaction significantly influenced loyalty but did not mediate the effects of any exogenous construct on loyalty. The model demonstrated moderate explanatory power (R^2 satisfaction = 0.512; R^2 loyalty = 0.491) with strong predictive relevance. The study's cross-sectional design limits causal inference. Future research should employ longitudinal designs to examine habit

strength, switching costs, and cross-regional variations beyond Java Island. Policymakers should prioritise functional performance and technical reliability over traditional service quality enhancements. Building institutional trust proves critical for sustaining loyalty in public-sector digital platforms facing private-sector competition. This study challenges traditional mediation-based service quality models by revealing that loyalty formation in e-government transportation services is driven primarily by functional value, technical performance, and institutional trust rather than satisfaction, offering novel insights for public-sector digital service management.

Keywords: e-government, citizen trust, citizen loyalty, citizen satisfaction, perceived usefulness.

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Introduction

Public service delivery is one of the core responsibilities of government institutions, and its quality often reflects the overall performance of public administration. As societies become increasingly connected through digital technologies, citizens expect public services that are not only efficient but also easy to access from anywhere at any time. In Indonesia, the development of digital governance has accelerated through the implementation of the Electronic Based Government System, which encourages the use of technology to improve service effectiveness and responsiveness (Nurmalah et al., 2024). This shift illustrates how digital transformation is reshaping the way government institutions interact with citizens and deliver essential services (Hanun & Prasetyo, 2023).

Transportation is one of the sectors most affected by these changes. Reliable public transportation supports economic activity, daily mobility, and regional connectivity, making it a key element of national development (Biomantara & Herdiansyah, 2019). Java, the most populated island in Indonesia, has experienced a rapid expansion of transportation infrastructure, including mass transit systems and railway upgrades, as part of broader efforts to improve mobility (Kemenhub, 2023). These developments have created a strong demand for digital solutions that allow citizens to plan their journeys more efficiently.

The official digital platform, "Access by KAI" (developed by PT Kereta Api Indonesia), is one of the government's main efforts to modernise public transportation services. This application provides ticket booking, travel information, and various complementary services within a single digital environment. Access by KAI is the

main government channel for rail ticketing on Java, but it is not the only one, since tickets can also be bought through commercial platforms and retail outlets. The platform has gained wide user adoption due to high smartphone usage and strong digital access among communities in Java (Frizni & Adnan, 2024). The island consistently records more than three hundred million railway passengers each year, making digital transportation services particularly essential (Badan Pusat Statistik, 2024). Java also has one of the highest levels of internet penetration in the country, which further supports the use of applications for transportation needs (APJII, 2025).

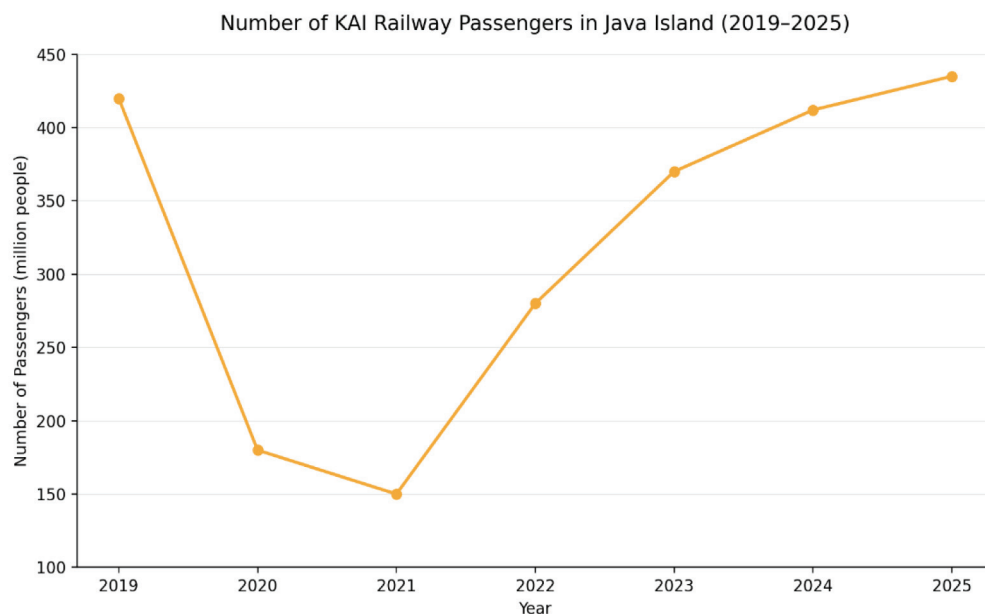


Figure 1: Railway passenger trips on Java Island, Indonesia

Source: (Badan Pusat Statistik [Statistics Indonesia], 2024; 2025; 2026).

The passenger trips volume of KAI in Java experienced substantial fluctuations between 2019 and 2023. In 2019, the number of passenger trips reached its highest level at over 400 million, reflecting normal operational demand prior to the pandemic. This figure then dropped sharply in 2020 to around 180 million due to large scale mobility restrictions and reduced public travel during the COVID period. The decline continued into 2021, falling to approximately 150 million passenger trips, marking the lowest point in the five year period. Recovery began in 2021 with strong growth to 2022, when passenger trips numbers increased to about 280 million following eased restrictions and the gradual normalisation of travel activities. By 2023, passenger trips volume had increased further to approximately 370 million (Badan Pusat Statistik, 2024). Growth continued into 2024, with Badan Pusat Statistik (2025) reporting year on year increases of 12.81 percent for Jabodetabek services and 11.03 percent for non-Jabodetabek Java services, suggesting total Java passenger trips approached 410 to 415 million. By 2025, according to the latest published figures, the number of passenger trips had risen to over 435 million in Java specifically

(Badan Pusat Statistik, 2026). It should be noted that these figures represent total railway trips recorded, not unique individual passengers, as a single passenger may make multiple trips within a year.

However, despite its potential, Access by KAI still faces several challenges. Users frequently report system errors, unstable features, and unsuccessful transactions, all of which can affect their overall experience and trust in the platform (Sjamsuridjal & Utami, 2020). Reviews on the Google Playstore also reveal recurring issues such as missing schedule data and slow system responses.

Third party platforms such as Traveloka, together with convenience stores, where staff sell tickets over the counter through a retail point of sale system, remain popular alternatives for purchasing train tickets, often surpassing the official application in transaction volume (Agus Triani & Yenita, 2023). These challenges highlight the need to understand what shapes user satisfaction and loyalty in government managed digital platforms.

While ticket sales can technically be delegated to commercial platforms, the existence of an official government-owned digital platform carries strategic significance that extends well beyond mere transactional functions. First, the official platform serves as a national data infrastructure, as passenger data collected through Access by KAI provides vital information for capacity planning, subsidy management, and public transportation policy that cannot be directly obtained from third-party platforms. Second, reliance on commercial platforms creates risks of data sovereignty and external dependency that run counter to the principles of digital governance under SPBE (Electronic-Based Government Systems). Third, in the context of rail-based transportation operated by a state-owned enterprise, maintaining a competitive official digital channel is part of public accountability and an effort to strengthen citizen trust in state services. Consequently, user loyalty toward Access by KAI is not merely a matter of market preference, but rather a strategic indicator of the effectiveness of the government's digital transformation.

Purchase patterns across ticketing channels show that Access by KAI handles under a third of railway ticket transactions in Java, behind both Traveloka and offline retail counters (Agus Triani & Yenita, 2023). The official platform therefore competes for its own users against commercial ecosystems with wider reach and larger digital footprints. That competition frames the objective of this study: to establish what keeps citizens using a government-owned application when commercial substitutes are readily available, and whether satisfaction is the mechanism that converts service quality into loyalty.

Existing research on digital services has examined the roles of digital service quality, digital trust, system quality, and perceived usefulness in influencing user behaviour. However, most of these studies focus on private sector applications rather than public transportation platforms operated by the government (Nasution & Adiwijaya, 2024). The literature also shows inconsistent findings regarding whether satisfaction functions as a mediating variable in digital service models, particularly in public sector contexts (Chikazhe et al., 2021). Moreover, only a limited number of studies have explored these four factors together within a large-scale government owned transportation application such as Access by KAI. These gaps indicate the need for a more comprehensive examination of what drives satisfaction and loyalty in this context.

To address these issues, this study investigates how digital service quality, digital trust, perceived usefulness, and system quality influence citizen satisfaction and citizen loyalty among users of Access by KAI in Java. Using Partial Least Squares Structural Equation Modelling, this study evaluates both the direct and indirect relationships among these variables, following methodological standards commonly applied in digital service research (Ghozali & Latan, 2015; Hair et al., 2021).

The findings of this study are expected to provide meaningful contributions in several ways. First, the results enrich current discussions on user behaviour in government operated digital transportation systems, an area that has received relatively limited attention. Second, the study offers empirical insights into the mediating role of satisfaction, which remains an ongoing debate in the literature (Oliver, 1999; Alkrajji & Ameen, 2021; Chikazhe et al., 2021). Finally, and most importantly, the study presents practical recommendations for PT Kereta Api Indonesia and government institutions to improve system performance, strengthen user trust, and enhance service delivery. Through these contributions, this research supports the broader agenda of improving digital public services and strengthening citizen experience in Indonesia's transportation sector.

Theoretically, this study is grounded in three interconnected theoretical frameworks from public administration and information systems. First, the Public Value Theory provides the overarching normative lens, positioning citizen satisfaction and loyalty not merely as marketing outcomes but as indicators of public value creation, where government digital services must deliver meaningful benefits to citizens while strengthening institutional legitimacy and democratic accountability (Moore, 2021). Second, the Digital Government perspective emphasises that ICT-mediated public services must be evaluated through citizen-centric criteria, where technical performance, trust, and usefulness are direct expressions of a government's capacity to serve the public interest (Mergel et al., 2019). Third, this study draws on the IS Success Model and Technology Acceptance Model as bridging frameworks that operationalise these public administration imperatives at the level of individual user behaviour, connecting system performance and perceived usefulness to broader public sector outcomes (Chan et al., 2021). Together, these frameworks reframe the study's variables, namely digital service quality, digital trust, perceived usefulness, and system quality, as dimensions of digital public value delivery rather than purely technical or commercial metrics.

Literature review

Digital service quality

Digital service quality describes how users perceive the performance of a digital service when they interact with an online system. In public sector platforms, service quality is closely tied to reliability, speed, accuracy, and how well the system supports citizens in completing tasks (Parasuraman et al., 2005). Prior studies emphasise that good digital service quality encourages citizens to feel more confident and satisfied when interacting with government applications (Prasetyo et al., 2023). In the context of transportation, service quality becomes even more critical because users rely on mobile applications to manage time-sensitive activities such as booking tickets

or accessing travel information. When systems run smoothly, users develop positive impressions, yet when errors, delays, or failures occur, dissatisfaction emerges quickly. This dual nature makes service quality one of the most influential elements behind the acceptance of digital transportation services (Lesmana & Balqiah, 2023). These findings underscore why improving system stability and responsiveness remains a priority for public transportation providers, including PT Kereta Api Indonesia. From a public administration standpoint, service design in e-government is a multidimensional construct that encompasses core service accuracy, facilitating service accessibility, and supporting service transparency, all of which jointly shape citizen satisfaction (Chan et al., 2021). Digital service quality is therefore not merely a technical concern but a manifestation of the government's commitment to citizen-centric service delivery as a public value obligation (Moore, 2021).

Digital trust

Digital trust refers to the degree of confidence that users have in a digital platform. In public transportation applications, trust involves believing that the system will process payments securely, protect personal data, and provide accurate information. Several studies argue that trust has become a decisive factor in shaping long term user behaviour, especially in government managed services where transparency and accountability are essential (Ashiq & Hussain, 2023). When trust is high, users are more willing to engage and to rely on the system repeatedly. Conversely, frequent errors, inaccurate information, or unstable processes can dramatically reduce trust and discourage continued use (Kartono & Halihah, 2019). For Access by KAI, booking failures and data inconsistencies are reported repeatedly in public user reviews on the Google Play Store and in earlier work on the application (Sjamsuridjal & Utami, 2020), which suggests that trust building must be addressed more explicitly. Trust is not only a psychological element but a technical outcome of robust system performance and clear communication. In the public administration literature, trust in digital government extends beyond individual transactions to encompass institutional legitimacy. Digitally-induced changes in government contribute to increased transparency and strengthened accountability, which in turn reinforce public trust in state institutions. For state-owned enterprises like PT KAI, digital trust thus functions as a proxy for institutional credibility.

Perceived usefulness

Perceived usefulness captures the extent to which users believe that a system helps them accomplish tasks more easily and effectively. Davis (1989) highlights that people adopt a technology when they feel it genuinely improves their performance. In digital transportation, usefulness is demonstrated when the application simplifies ticket purchasing, provides accurate schedules, or reduces the time required for travel planning. Previous research confirms that when users view a system as beneficial, they tend to be more engaged and more satisfied, which ultimately strengthens loyalty (Han & Sa, 2022). In the case of Access by KAI, the integration of features such as ticket booking, travel history, and service updates offers strong potential value. However, usefulness is only realised when these features work consistently. Thus, usefulness becomes a dynamic perception shaped by both system design and user

experience. Public Value Theory frames usefulness not only as individual utility but also as the degree to which a service advances collective benefit (Moore, 2021). When citizens perceive a government digital platform as genuinely useful, they implicitly affirm that the state is fulfilling its service mandate effectively (Chan et al., 2021).

System quality

System quality refers to the technical soundness of a digital platform, including speed, reliability, and error free functionality. In public sector applications, system quality often becomes the most visible indicator of government digital performance. The DeLone and McLean Model (2016) emphasises that system quality strongly influences user satisfaction because technical failures directly interrupt service delivery. Studies in transportation applications show that poor system quality such as slow loading times, unexpected system delays, or sudden crashes discourages users and reduces trust (Zamir & Kim, 2022). Users of Access by KAI have reported similar issues, including inaccurate data display and unsuccessful transactions. These recurring problems highlight the need for stronger system infrastructure to create a smoother and more dependable experience. Improving system quality not only enhances practical usability but also communicates institutional competence and reliability to the public. Technology-enabled service processes can streamline time and cost while automation reduces the risk of human errors, reinforcing that system quality in e-government is not a purely technical metric but a signal of governmental competence and responsiveness to public needs (Mergel et al., 2019).

Citizen satisfaction

Citizen satisfaction represents how well digital services meet citizens' expectations. Satisfaction is a key indicator of digital service success because it reflects real user experiences rather than internal performance metrics. Research consistently finds that satisfaction is strongly shaped by service quality, trust, system reliability, and perceived usefulness (Fornell, 1992). In public transportation, satisfaction becomes particularly sensitive because mobility services directly affect daily routines. When applications work efficiently, citizens express higher satisfaction, leading to stronger engagement. However, recent findings suggest that satisfaction does not always mediate the relationship between system attributes and loyalty, indicating complex behavioral dynamics in digital government services (Chikazhe et al., 2021). Understanding these dynamics is crucial for government agencies seeking to build stronger digital service ecosystems. In the public administration literature, citizen satisfaction is a key outcome of great concern to both scholars and practitioners, as it reflects whether the government has successfully translated public investment in digital infrastructure into tangible benefits for citizens (Alkraihi & Ameen, 2021; Chan et al., 2021).

Citizen loyalty

Citizen loyalty refers to the commitment of users to continue using a digital platform over time and to choose it over competing services. In sectors with multiple alternatives, such as transportation, loyalty is essential for platform sustainability. Studies indicate that loyalty is shaped not only by satisfaction but also by trust and perceived

usefulness (Oliver, 1999). Loyalty in government applications carries additional significance because it reflects public confidence in state institutions. If citizens prefer private ticketing platforms over official government applications, it suggests a gap in performance or reliability. Therefore, loyalty becomes a strategic indicator of whether the government successfully delivers high quality digital services (Biomantara & Herdiansyah, 2019). Strengthening loyalty requires consistent quality, reliable systems, and transparent interactions across all digital touchpoints. In the context of Public Value Theory, loyalty toward a government platform signals that citizens perceive the service as delivering sustained public value, which is a critical measure of e-government success beyond transactional metrics (Alkrajji & Ameen, 2021; Moore, 2021)

Research model

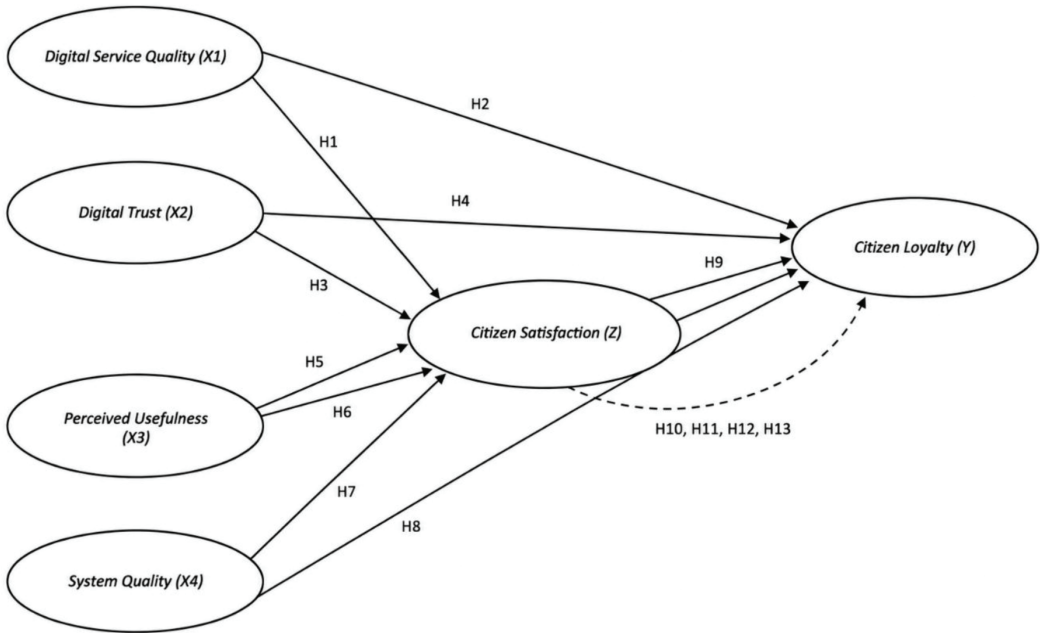


Figure 2. Research model

Source: compiled by the authors.

- H1: Digital Service Quality influences Citizen Satisfaction.
- H2: Digital Service Quality influences Citizen Loyalty.
- H3: Digital Trust influences Citizen Satisfaction.
- H4: Digital Trust influences Citizen Loyalty.
- H5: Perceived Usefulness influences Citizen Satisfaction.
- H6: Perceived Usefulness influences Citizen Loyalty.
- H7: System Quality influences Citizen Satisfaction.
- H8: System Quality influences Citizen Loyalty.
- H9: Citizen Satisfaction influences Citizen Loyalty.
- H10: Digital Service Quality has an indirect effect on Citizen Loyalty through Citizen Satisfaction.

H11: Digital Trust has an indirect effect on Citizen Loyalty through Citizen Satisfaction.

H12: Perceived Usefulness has an indirect effect on Citizen Loyalty through Citizen Satisfaction.

H13: System Quality has an indirect effect on Citizen Loyalty through Citizen Satisfaction.

Methods

This study employed a quantitative research design to examine the relationships among digital service quality, digital trust, perceived usefulness, system quality, citizen satisfaction, and citizen loyalty in the context of the Access by KAI application. A quantitative approach was selected because it allows systematic measurement of latent variables and statistical testing of causal relationships through structural modelling, which is consistent with recommendations for evaluating digital service performance in public sector environments (Ghozali & Latan, 2015; Hair et al., 2021).

The population of this study consisted of users of the Access by KAI application residing on the island of Java. Java was selected because it represents the region with the highest concentration of railway passengers in Indonesia, making it the most relevant setting for evaluating digital transportation services. A total of 324 respondents participated in the study, and this sample size fulfilled the minimum criteria for Partial Least Squares Structural Equation Modelling, which requires a sample larger than ten times the highest number of indicators in any construct (Hair et al., 2021). Furthermore, Cohen's power analysis recommends a minimum of 59 respondents for detecting medium effect sizes ($f^2 = 0.15$) at 80% statistical power with five predictors, while the ten-times rule applied to the highest number of indicators (four indicators in the loyalty construct) requires only 40 respondents. The achieved sample of 324 respondents substantially exceeds both criteria, providing adequate statistical power and stability for PLS-SEM estimation (Hair et al., 2021). Respondents were selected using nonprobability sampling with a purposive approach, ensuring that only individuals who had used Access by KAI within the last three months were included.

Data were collected through an online questionnaire distributed via digital platforms. Data collection was conducted between September and November 2025. The instrument consisted of structured items adapted from validated scales used in previous studies on digital service quality and technology acceptance. Items measuring digital service quality were adapted from the ESERVQUAL model developed by Parasuraman et al. (2005), digital trust items were adopted from prior studies on trust in digital public services, perceived usefulness items were based on the Technology Acceptance Model proposed by Davis (1989), and system quality items were adapted from the Information Systems Success Model by DeLone and McLean (2016). All items used a five-point Likert scale to capture the intensity of respondents' perceptions. The five-point Likert scale ranged from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). Mean scores reported in Table 2 reflect the average respondent agreement for each item, where values above 4.00 indicate generally

high agreement and values approaching 5.00 indicate near-unanimous agreement among respondents

Before data analysis, the instrument underwent validity and reliability testing to ensure its adequacy for structural modelling. Convergent validity, discriminant validity, and internal consistency reliability were evaluated following established guidelines in PLS SEM literature (Hair et al., 2021). Items that failed to meet the threshold values for loading factors or reliability were excluded from further analysis.

Data were analysed using Partial Least Squares Structural Equation Modelling with the SmartPLS software. This method was chosen due to its suitability for prediction-oriented research, its ability to estimate complex models with multiple constructs, and its robust performance when the distribution of data does not meet normality assumptions (Ghozali & Latan, 2015). The analysis consisted of two stages. The first stage assessed the measurement model by testing indicator reliability, composite reliability, average variance extracted, and discriminant validity. The second stage tested the structural model by evaluating path coefficients, effect sizes, coefficient of determination, and significance levels using bootstrapping procedures with recommended resampling iterations.

Ethical procedures were observed throughout data collection. Respondents participated voluntarily, and no identifiable personal information was collected. The findings were generated strictly from aggregated data, ensuring confidentiality and anonymity.

Results

Demographic profile

A total of 324 respondents participated in this study, all of whom were users of the Access by KAI application residing on the island of Java. The demographic variables collected include gender, age, and domicile. These characteristics help illustrate the composition of the sample and provide important contextual information for interpreting the study's findings.

Female respondents represented the majority, with 204 individuals or 63% of the sample. Male respondents accounted for 120 individuals or 37%. This distribution suggests that female users are more actively engaged with the Access by KAI application, contributing a larger share of participation in the survey.

The age distribution shows that most users are younger individuals, with the share falling steadily across the older categories to an almost negligible proportion above 55 years. This matches national internet user demographics, in which the 13–18 and 19–34 age groups together form the largest share of Indonesian internet users (APJII, 2025). Respondents were not recruited exclusively from educational settings; data were collected through open digital channels including social media platforms and online communities of Access by KAI users. The skewed age distribution nonetheless remains a limitation of the purposive sampling approach and is acknowledged in the limitations section.

Respondents came from all six provinces of Java. East Java supplied the largest share at 31.2%, followed by West Java at 28.7% and Central Java at 21.6%, with Banten, DKI Jakarta and the Special Region of Yogyakarta accounting for the remaining

18.5%. This ordering broadly tracks provincial population size, the main exception being East Java, which is over-represented relative to West Java, the most populous province on the island. The sample therefore covers users from across Java rather than from a single region.

Overall, the demographic profile demonstrates that Access by KAI users who participated in this study were predominantly female, mostly young adults, and distributed across all major provinces in Java. These characteristics are important for understanding how demographic factors may shape user perceptions of digital service quality, digital trust, perceived usefulness, and system quality within a government operated digital transportation platform.

Table 1

Respondent's demographic profile

Demographic Variables		Frequency	Percentage
Gender	Male	120	37%
	Female	204	63%
	Total	324	100%
Age	17–25	215	66.4%
	26–35	71	21.9%
	36–45	29	9%
	46–55	8	2.5%
	>55	1	0.3%
	Total	324	100%
Domicile	Banten	22	6.8%
	DKI Jakarta	25	7.7%
	West Java	93	28.7%
	Central Java	70	21.6%
	Yogyakarta	13	4%
	East Java	101	31.2%
	Total	324	100%

Source: Compiled by the authors (- here and below, if otherwise specified).

Evaluating reflective measurement models (outer model)

The outer model evaluation was conducted to assess the reliability and validity of each construct in the measurement model. All reflective constructs demonstrated satisfactory performance based on outer loading values, composite reliability, and average variance extracted. The indicators of digital service quality showed strong measurement stability, with outer loading values ranging from 0.71 to 0.86, composite reliability of 0.881, and an average variance extracted of 0.651.

These results indicate that the indicators measuring clarity of information, service suitability, ease of use, and perceived security were highly consistent in representing the construct.

The digital trust construct also met the reliability and validity standards, with outer loading values between 0.81 and 0.82, composite reliability of 0.856, and an average variance extracted of 0.665. This demonstrates that user confidence in the application's efforts to assist users, reliability in providing services, and consistent reputation building were well captured by the indicators. Perceived usefulness showed good construct measurement quality as well, supported by outer loading values ranging from 0.76 to 0.81, composite reliability of 0.834, and an average variance extracted of 0.627, indicating that the items regarding efficiency, ease in booking, and overall usefulness adequately reflected the construct.

System quality demonstrated solid psychometric properties, with outer loading values between 0.77 and 0.84, composite reliability of 0.838, and an average variance extracted of 0.633, confirming that the indicators related to modern appearance, ease of use, and system responsiveness contributed well to representing system quality. Citizen satisfaction also showed strong measurement reliability, with outer loading values ranging from 0.79 to 0.83, composite reliability of 0.849, and an average variance extracted of 0.653, indicating that user expectations, overall satisfaction, and fulfillment of railway service needs were measured consistently.

Finally, the citizen loyalty construct demonstrated high reliability, supported by outer loading values ranging from 0.74 to 0.83, composite reliability of 0.869, and an average variance extracted of 0.625. The indicators measuring intention to reuse, willingness to recommend, consistency in choosing the application, and ongoing support showed strong and stable contributions to the construct. Overall, the outer model results confirm that all constructs fulfill the required thresholds for reliability and validity, allowing the analysis to proceed to the structural model evaluation. The complete survey instrument is presented in Table 2, which lists all measurement items used in data collection.

Table 2

Mean, construct validity and construct reliability

Variable	Item	Item measure	Mean	Outer loading	Composite reliability	AVE
Digital Service Quality	X1.1	The information I need in the Access by KAI application is easy to find and presented clearly	4.33	0.853	0.881	0.651
	X1.2	The services provided in the Access by KAI application meet my needs as a user	4.33	0.791		
	X1.3	I rarely encounter difficulties when using the Access by KAI application	3.89	0.713		
	X1.4	I feel that my personal data and transactions in the Access by KAI application are secure	4.30	0.862		

Variable	Item	Item measure	Mean	Outer loading	Composite reliability	AVE
Digital Trust	X2.1	I believe that the Access by KAI application makes genuine efforts to assist and resolve user issues	4.24	0.810	0.856	0.665
	X2.2	I trust the Access by KAI application to reliably provide railway services	4.37	0.812		
	X2.3	I believe that the Access by KAI application maintains its reputation and delivers services consistently	4.34	0.824		
Perceived Usefulness	X3.1	The Access by KAI application helps me manage my railway trips more efficiently	4.30	0.769	0.834	0.627
	X3.2	The Access by KAI application simplifies the process of booking and using railway services	4.50	0.812		
	X3.3	Overall, the Access by KAI application is useful for my travel needs	4.44	0.794		
System Quality	X4.1	The appearance and features of the Access by KAI application meet the standards of modern applications	4.23	0.772	0.838	0.633
	X4.2	I find the Access by KAI application easy to use without requiring significant effort	4.48	0.771		
	X4.3	The Access by KAI application responds quickly when I use it	4.32	0.842		
Citizen Satisfaction	Z.1	The services provided by the Access by KAI application meet or even exceed my expectations	4.07	0.790	0.849	0.653
	Z.2	Overall, I am satisfied with the services provided by the Access by KAI application	4.18	0.831		
	Z.3	The Access by KAI application is able to meet my needs as a railway service user	4.41	0.802		
Citizen Loyalty	Y.1	I plan to continue using the Access by KAI application every time I travel by train	4.49	0.780	0.869	0.625
	Y.2	I am willing to recommend the Access by KAI application to others	4.41	0.745		
	Y.3	I will continue choosing the Access by KAI application even when similar applications are available	4.34	0.803		
	Y.4	I will keep supporting and using the Access by KAI applications because of its quality	4.40	0.832		

The Heterotrait Monotrait Ratio results indicate that all constructs in the model demonstrate strong discriminant validity. The HTMT values range from 0.552 to 0.843, all well below the conservative threshold of 0.85 and far from the more liberal limit of 0.90, confirming that each construct is empirically distinct. The lowest HTMT value is observed between Digital Service Quality and Citizen Loyalty at 0.552, showing that these constructs are clearly differentiated, while the highest value of 0.843 appears between System Quality and Citizen Satisfaction, which still falls within the acceptable limits. Other notable relationships, such as between Digital Trust and Digital Service Quality at 0.822, between Perceived Usefulness and Citizen Satisfaction at 0.835, and between System Quality and Perceived Usefulness at 0.727, all support the conclusion that multicollinearity is not a concern and that each latent variable measures a unique conceptual domain within the structural model.

Table 3

Heterotrait-monotrait ratio (HTMT)

	Citizen Loyalty	Citizen Satisfaction	Digital Service Quality	Digital Trust	Perceived Usefulness	System Quality
Citizen Loyalty						
Citizen Satisfaction	0.724					
Digital Service Quality	0.552	0.682				
Digital Trust	0.650	0.633	0.822			
Perceived Usefulness	0.801	0.835	0.682	0.707		
System Quality	0.762	0.843	0.617	0.634	0.727	

Evaluation of the structural models (inner model)

The inner model assessment examines the structural relationships between the latent variables in the study and evaluates how well the proposed framework explains and predicts the endogenous constructs within the Access by KAI user behaviour model. This stage includes an analysis of the coefficient of determination to assess the explanatory power of the model, predictive relevance to determine the accuracy and robustness of the structural predictions, and hypothesis testing for both direct and indirect effects among the variables. By assessing these components, the inner model provides a comprehensive understanding of the causal pathways that connect digital service quality, digital trust, perceived usefulness, and system quality to citizen satisfaction and citizen loyalty within the digital public transportation context.

Hypothesis testing was conducted using the bootstrapping procedure with 5,000 resamples, which generates an empirical sampling distribution without nor-

mality assumptions. The T-statistic represents the ratio of the path coefficient to its standard error derived from the bootstrapped distribution. A hypothesis is considered supported when the T-statistic exceeds the critical value of 1.96 (two-tailed, $\alpha = 0.05$), corresponding to a p-value below 0.05. This threshold is the standard significance criterion applied in PLS-SEM literature (Hair et al., 2021).

The coefficient of determination was used to evaluate the explanatory power of the structural model. As can be seen from Table 4 the Citizen Satisfaction indicator has an R-square value of 0.512 with an adjusted value of 0.505, indicating that the combination of Digital Service Quality, Digital Trust, Perceived Usefulness, and System Quality explains 51.2% of the variance in Citizen Satisfaction. This demonstrates a substantial level of predictive accuracy for a behavioral research model. Meanwhile, Citizen Loyalty obtained an R Square value of 0.491 with an adjusted value of 0.483, suggesting that Citizen Loyalty is explained by Citizen Satisfaction along with the four exogenous variables at a rate of 49.1%. These findings indicate that both endogenous constructs fall within the moderate explanatory category, implying that the model possesses a meaningful but not excessive level of predictive strength suitable for studies in digital public service contexts.

Table 4

Coefficient of determination

Indicator	R-square	R-square adjusted
Citizen Loyalty	0.491	0.483
Citizen Satisfaction	0.512	0.505

The predictive assessment using PLS Predict demonstrates that the structural model has solid out of sample predictive power. This can be observed by comparing the PLS SEM errors with those generated by the naive linear model benchmark. Across all indicators of citizen loyalty and citizen satisfaction, the PLS SEM model shows lower or equal RMSE and MAE values, indicating superior prediction accuracy. For example, the RMSE for indicators of citizen loyalty ranges from 0.548 to 0.626 in the PLS SEM model, which is consistently lower than or comparable to the linear model values that range from 0.563 to 0.634. A similar pattern appears in the satisfaction indicators, where RMSE values in PLS SEM fall between 0.557 and 0.619, again showing improved or stable performance compared to the benchmark.

The Q square predict values further confirm the model's predictive relevance. All indicators produce positive Q square predict values, which range from 0.233 to 0.344 for loyalty and from 0.298 to 0.344 for satisfaction. Positive values indicate that the PLS SEM model outperforms the naïve benchmark and is capable of generating meaningful predictions for new data. Indicators Y₄ (0.326) and Z₃ (0.344) show the strongest predictive capability, suggesting that the model captures user behaviour particularly well in these areas. Overall, the predictive results presented in Table 5 demonstrate that the model possesses moderate to high predictive power, reinforcing the reliability of the inner structural relationships.

Table 5

PLS Predict

	PLS-SEM			Linear Model (naive LM benchmark)		
	RMSE	MAE	Q ² _predict	RMSE	MAE	Q ² _predict
Y.1	0.601	0.471	0.268	0.612	0.470	0.242
Y.2	0.626	0.510	0.233	0.626	0.494	0.233
Y.3	0.622	0.490	0.312	0.634	0.495	0.286
Y.4	0.548	0.450	0.326	0.563	0.456	0.289
Z.1	0.619	0.491	0.302	0.621	0.495	0.298
Z.2	0.608	0.484	0.298	0.604	0.478	0.306
Z.3	0.557	0.444	0.344	0.568	0.442	0.318

The results of the direct effect analysis indicate that several constructs exert significant influences within the proposed model. Table 6 presents the results of direct effect hypothesis testing, in which the arrow (→) denotes the hypothesised direction of effect from the predictor to the outcome. Perceived usefulness and system quality show strong and statistically significant effects on both citizen satisfaction and citizen loyalty, demonstrating that functional value and technical performance play major roles in shaping user outcomes. Digital service quality also contributes significantly to citizen satisfaction, although it does not directly influence citizen loyalty.

Digital trust, on the other hand, displays a significant direct effect on loyalty but not on satisfaction, suggesting that trust functions more as a driver of behavioral commitment than immediate evaluative response. Meanwhile, the link between satisfaction and loyalty is statistically significant, confirming that satisfied users tend to exhibit stronger intentions to continue using the Access by KAI application. Overall, these direct relationships highlight the central role of usefulness, system performance, and trust in determining user loyalty within digital public transportation services.

The analysis of indirect effects reveals that citizen satisfaction does not function as a strong mediating variable between the exogenous constructs and citizen loyalty. Table 7 presents the results of indirect effect hypothesis testing or mediation testing. The mediation paths from digital service quality, digital trust, perceived usefulness, and system quality toward citizen loyalty through citizen satisfaction all show nonsignificant results, as indicated by *t* values below the conventional threshold of 1.96 and *p* values greater than 0.05. These findings suggest that although several exogenous variables exert direct influence on loyalty, their indirect influence through satisfaction remains limited. In this model, satisfaction does not substantially transmit or strengthen the impact of digital service quality dimensions on loyalty outcomes, indicating that users' loyalty toward Access by KAI is shaped more by direct perceptions of usefulness, trust, and system performance rather than by satisfaction as an intermediary mechanism.

Table 6

Hypothesis testing of direct effect

Path	T Statistics	P Values
E-Service Quality → Citizen Satisfaction	2.463	0.014
E-Service Quality → Citizen Loyalty	0.243	0.808
E-Trust → Citizen Satisfaction	0.484	0.629
E-Trust → Citizen Loyalty	2.688	0.007
Perceived Usefulness → Citizen Satisfaction	4.283	0.000
Perceived Usefulness → Citizen Loyalty	4.084	0.000
System Quality → Citizen Satisfaction	6.006	0.000
System Quality → Citizen Loyalty	4.526	0.000
Citizen Satisfaction → Citizen Loyalty	2.036	0.042

Table 7

Hypothesis testing of indirect effect

Path	T Statistics	P Values
E-Service Quality → Citizen Satisfaction → Citizen Loyalty	1.467	0.143
E-Trust → Citizen Satisfaction → Citizen Loyalty	0.445	0.675
Perceived Usefulness → Citizen Satisfaction → Citizen Loyalty	1.833	0.067
System Quality → Citizen Satisfaction → Citizen Loyalty	1.915	0.056

Discussion**E-service quality and its differential effects**

E-service quality significantly influences citizen satisfaction ($t=2.463$, $p=0.014$), consistent with Prasetyo et al. (2023) in Indonesia's government services and Alnaim et al. (2022) in online travel agencies. The high mean scores for information accessibility (4.33) and data security (4.30) demonstrate that when users experience efficient information retrieval and secure transactions, their immediate satisfaction increases. This aligns with Surya et al. (2024) who found that system and service quality dimensions significantly impact citizen satisfaction in Nepal's e-governance platforms.

However, e-service quality does not directly influence citizen loyalty ($t=0.243$, $p=0.808$), contradicting findings in commercial contexts by Alnaim et al. (2022) and Venkatakrishnan et al. (2023), but supporting Lesmana and Balqiah (2023) and Nasution and Adiwijaya (2024) in Indonesian digital utility services. This divergence suggests a fundamental difference between commercial and public service platforms. In commercial contexts, service quality creates competitive differentiation, whereas in monopolis-

tic public services like rail transportation, users evaluate loyalty through functional necessity rather than service aesthetics. Lesmana and Balqiah (2023) explain that in utility applications like PLN Mobile, users activate apps only for specific needs, making service quality insufficient for sustaining long-term loyalty without functional superiority. This situational usage pattern appears to characterise Access by KAI users who engage with the app primarily during travel planning periods rather than continuously.

The trust paradox in public service apps

E-trust exhibits an asymmetric pattern: it does not significantly affect satisfaction ($t=0.484$, $p=0.629$) but strongly influences loyalty ($t=2.688$, $p=0.007$). This contradicts Alnaim et al. (2022) in commercial platforms but supports recent Indonesian studies by Kedaton et al. (2024) and Malau and Sitanggang (2024). The phenomenon can be explained through the concept of institutional trust as a hygiene factor in state-owned enterprise contexts. Indonesian citizens possess a priori trust in PT KAI as the national rail operator, functioning as a baseline expectation rather than a differentiating factor that enhances satisfaction.

The direct trust-loyalty pathway aligns with Mas-Machuca et al. (2021) in European transportation platforms and Siswadi et al. (2023) in Indonesian ride-hailing services, who demonstrate that trust creates institutional commitment independent of transactional satisfaction. Users remain loyal to Access by KAI because they trust the legitimacy and data security of the official platform, even when individual transactions may not maximise satisfaction. This suggests that in public transportation apps, trust operates through cognitive-normative mechanisms (institutional credibility and security assurance) rather than affective-evaluative pathways (satisfaction with service experiences).

Perceived usefulness as a dual pathway driver

Perceived usefulness significantly influences both satisfaction ($t=4.283$, $p<0.001$) and loyalty ($t=4.084$, $p<0.001$), supporting Wilson et al. (2021), Maryanto and Kaihatu (2021), and Tsui (2019). The high mean scores for booking convenience (4.50) and overall utility (4.44) align closely with continued use intention (4.49), demonstrating that functional benefits create both immediate satisfaction and long-term commitment. This dual pathway is consistent with Technology Acceptance Model predictions that perceived usefulness influences both attitudes and behavioural intentions (Davis, 1989).

The strength of the direct usefulness-loyalty relationship ($t=4.084$) suggests that in utility-based applications, users develop instrumental loyalty based on rational-economic evaluations of time savings, convenience, and efficiency gains. Maryanto and Kaihatu (2021) found similar patterns in Grab users, where perceived usefulness created commitment through functional value rather than emotional attachment. This rational loyalty formation distinguishes public transportation apps from hedonic commercial platforms where loyalty stems more from affective satisfaction.

System quality as the dominant determinant

System quality emerged as the strongest predictor of both satisfaction ($t=6.006$, $p<0.001$) and loyalty ($t=4.526$, $p<0.001$), reinforcing Surya et al. (2024), Zamir and Kim (2022), and Cahyoadi (2024). The emphasis on ease of use (mean=4.48)

and response speed (mean=4.32) indicates that technical performance is paramount in utility-based applications where users prioritise functional reliability. This finding extends the IS Success Model by demonstrating that in time-sensitive transaction contexts like ticket booking, system quality surpasses other quality dimensions in importance.

The strong direct effect on loyalty ($t=4.526$) suggests that superior system performance creates usage habits and psychological switching costs. Putri and Pujani (2019) and Mas-Machuca et al. (2021) explain that consistent technical performance fosters habit formation, where users resist changing platforms due to familiarity with interfaces and accumulated transaction histories. The near-identical means for response speed (4.32) and resistance to switching (4.34) support this habit formation mechanism. Users who experience fast, reliable systems develop cognitive routines that make alternative platforms psychologically costly to adopt.

Satisfaction's limited role in loyalty formation

Citizen satisfaction significantly but weakly influences loyalty ($t=2.036$, $p=0.042$), supporting Supriyanto et al. (2021) and Chikazhe et al. (2021) but revealing a substantially weaker relationship than in commercial contexts. More critically, satisfaction fails to mediate any of the hypothesised pathways from e-service quality ($t=1.467$, $p=0.143$), e-trust ($t=0.445$, $p=0.675$), perceived usefulness ($t=1.833$, $p=0.067$), or system quality ($t=1.915$, $p=0.056$) to loyalty. These non-significant mediation effects contradict traditional service quality frameworks but align with recent Indonesian digital platform studies (Magistra & Agustini, 2024; Florence & Aprillia, 2025; Saputra & Binastuti, 2025).

This pattern reveals that satisfaction operates independently from the functional attributes that most strongly drive loyalty. Florence and Aprillia (2025) explain that in Indonesian e-commerce, trust influences loyalty through cognitive-normative pathways while satisfaction operates through affective-evaluative pathways, with limited interaction between these mechanisms. Similarly, Raihan and Soepatini (2023) found that perceived usefulness directly shapes brand loyalty without requiring satisfaction as an intermediary, as functional benefits create instrumental commitment independent of emotional gratification.

The absence of mediation effects suggests three theoretical insights. First, in utility-based government applications, loyalty formation follows rational-economic logic rather than affective attachment. Users remain loyal because the app serves necessary functions efficiently, not because they feel emotionally satisfied. Second, the strong direct effects from system quality ($t=4.526$) and perceived usefulness ($t=4.084$) overshadow the weak mediation pathways through satisfaction ($t=2.036$), indicating that habit formation and lock-in effects bypass emotional satisfaction. Third, in contexts where users have low switching costs to competitor platforms, satisfaction alone cannot sustain loyalty without superior functional performance.

Comparison with existing literature

These findings both confirm and challenge existing theoretical frameworks. Consistent with the IS Success Model of DeLone and McLean (2016), system quality proves crucial for user satisfaction and net benefits. However, the model's assump-

tion that satisfaction mediates quality dimensions' effects on usage is not supported in this utility-based public service context. Similarly, while TAM posits that perceived usefulness influences attitudes leading to intentions, our findings suggest that in necessity-driven applications, usefulness directly creates behavioural commitment without requiring attitudinal mediation.

The differential effects of e-service quality (significant for satisfaction but not loyalty) versus system quality and perceived usefulness (significant for both) suggest that in public transportation apps, users distinguish between "service" aspects (information presentation, transaction processes) that affect immediate experiences and "system" aspects (performance, reliability, utility) that determine continued usage. This distinction is not prominent in commercial platform literature but appears critical in public utility services.

The trust-loyalty connection without satisfaction mediation contrasts with commercial platform findings Alnaim et al. (2022) but aligns with public service contexts where institutional credibility operates independently of transactional satisfaction (Surya et al., 2024). This suggests that trust functions differently across sectors: in commercial contexts, trust enhances satisfaction through service reliability perceptions, while in public services, trust provides institutional legitimacy that directly secures loyalty.

Limitations and future research

This study focuses exclusively on Access by KAI users in Java Island, Indonesia's most developed region with 89.40% internet penetration. Future research should examine whether these patterns hold in regions with lower digital literacy or different cultural contexts. The cross-sectional design captures relationships at one time point; longitudinal studies could reveal how satisfaction and loyalty evolve as users gain experience with the platform.

The study measured perceived system quality and usefulness through self-reports rather than objective performance metrics. Future research incorporating actual system response times, error rates, and usage frequency data could provide more robust evidence for habit formation mechanisms.

Additionally, the non-significant mediation effects suggest alternative pathways warrant exploration, such as habit strength, switching costs, or competitive alternatives as moderators.

The sample skews toward young, highly educated, and economically active users. Whether these patterns generalise to older, less educated, or infrequent users remains unclear. Future studies should oversample these underrepresented segments to test whether satisfaction plays a stronger mediating role when users lack strong functional dependencies or trust in institutions.

Finally, Access by KAI operates in a semi-monopolistic context where PT. KAI controls the rail infrastructure but competes with third-party booking platforms. This unique competitive structure may explain why functional superiority (system quality, usefulness) matters more than service quality. Comparative studies with fully competitive transportation platforms (ride-hailing) or fully monopolistic public services (electricity) could clarify how market structure shapes loyalty formation mechanisms.

Conclusions

This study contributes empirical evidence that loyalty formation in e-government transportation services follows rational-functional logic rather than traditional affective satisfaction pathways. Analysis of 324 Access by KAI users reveals that system quality ($t=4.526$) and perceived usefulness ($t=4.084$) exert the strongest direct effects on citizen loyalty, while e-trust ($t=2.688$) operates independently through institutional credibility mechanisms. Critically, citizen satisfaction fails to mediate any quality dimension-loyalty relationships, contradicting conventional service frameworks but aligning with recent Indonesian digital utility platform studies. These findings demonstrate that in utility-based public services with situational usage patterns, users prioritise technical performance, functional benefits, and institutional trust over service aesthetics or emotional satisfaction. For practitioners, sustained loyalty requires continuous system optimisation, exclusive feature development that enhances perceived usefulness, and transparent institutional trust reinforcement satisfaction management alone proves insufficient without concurrent functional superiority. The study's limitation to Java Island's highly digitally-literate population and cross-sectional design necessitates future longitudinal research across diverse demographic segments and regional contexts. Future studies should incorporate objective performance metrics, examine habit strength and switching costs as moderating mechanisms, and conduct comparative analyses across different market structures to clarify how competitive dynamics shape loyalty formation pathways in e-government contexts. Ultimately, this research advances theoretical understanding that e-government loyalty models require fundamental reconceptualisation beyond customer satisfaction paradigms dominant in commercial literature.

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AI GOVERNANCE SUSTAINABILITY TRAJECTORIES: INSIGHTS FROM CHINA

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Abstract. The aim of this study is to highlight the importance of adopting a more systematic approach to the interplay between AI governance and governance-oriented sustainability. It offers a synthesis of sustainable AI policy measures at the national and global level. More specifically, it assesses whether China's current governance-oriented AI policies are sufficient for the AI-governance era and whether additional mechanisms may be required. Ultimately, this study examines policy-exchange opportunities between China and other national contexts. This paper draws on a qualitative assessment of sustainable measures of AI governance and the sustainability of AI governance. Priority is given to the latter, and a "sustainability by integration" approach is advanced, which, at its core, serves as a necessary condition for explainable, accountable and trustworthy AI governance systems. The inquiry chiefly examines the governance-oriented sustainability of AI governance arrangements. Most research focuses on how AI is applied to strengthen governance, with limited attention given to the sustainable integration of AI governance. By contrast, China's wide-ranging approach to sustainable AI governance is most aligned with advancing a "sustainability by integration" approach. A number of pathways have been recognised through which China's measures can be adapted for use in other national governance settings. A broad set of national AI governance strategies issued up to 21 May 2025 was reviewed to assess how far they emphasise the linkage between governance and AI governance. In addition, the paper reviews China's policy and how it seeks to address AI governance through a sustainability lens.

Keywords. Artificial intelligence (AI) governance, China, sustainability, governance-oriented policy, Action Plan for Good and for All, data governance framework, National AI governance strategies.

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Introduction

In recent years, artificial intelligence (AI) has begun to influence key areas of public governance, and even though recent studies show persistent implementation barriers, it remains a focal point of attention globally. Research institutions, governments, and industry actors have increasingly examined the implications of these emerging technologies.

Whilst the focus to date has been directed toward the development and application of AI systems in the areas of public service delivery, social protection, and digital administration, the relationship between AI systems and sustainability has also become a relevant analytical concern. From an applied perspective, AI may be understood as a catalyst and a driver of sustainable development, whether in digital public services or data-driven administrative systems. In parallel, sustainable AI governance can be an objective in its own right.

However, many research articles and policy papers taken together overlook the governance-oriented implications of AI systems. The integration and development of AI governance mechanisms may raise questions regarding their long-term institutional sustainability.

This study, accordingly, seeks to clarify how policy documents address the question of AI governance sustainability. It will offer an outline of existing AI governance, with a focus on national AI governance programmes and their consideration of sustainability. This study will subsequently concentrate on China’s position in the domain of AI governance sustainability, as China has increasingly positioned itself as one of the actors in this area.

Its broad AI governance agenda points to sustainability challenges, while China’s AI Capacity-Building Action Plan for Good and for All, proposed to advance the implementation of UN General Assembly Resolution 78/311, signals a commitment to strengthening governance responses to emerging AI systems (Ministry of Foreign Affairs of the People’s Republic of China, 2024; United Nations General Assembly, 2024). Finally, the paper will consider the avenues for mutual learning and collaboration among China, other countries, and international participants on sustainability of AI governance.

The present paper will examine both the sustainable functions of AI governance, i.e. AI governance as a driver of governance-oriented sustainability, and the sustainability of AI governance itself. However, this paper lays emphasis on the latter and proposes the “sustainability by integration” approach, which in essence supports the development of explainable, accountable and trustworthy AI governance systems. Moreover, although sustainability is a wide concept and covers social, economic and institutional domains, this study will chiefly concentrate on governance-oriented sustainability.

Methodological approach

This study adopts a conceptual and documentary policy analysis to examine the sustainability of AI governance through established analytical frameworks. The analysis interprets how policy documents frame the sustainability of AI governance through governance objectives and implementation measures, while identifying common policy approaches across national and international frameworks.

A focused analytical outline of national Chinese policies and measures on AI governance will also be described. For this purpose, core materials, namely Chinese government documents and international governance documents on AI, will be examined. Focus will be placed on China's national AI governance strategies and those of international bodies. Strategies form a useful point of departure for examining the relationship between AI governance and sustainability, and often set out concrete governance objectives and planned measures to advance sustainable AI governance development and implementation. This paper incorporates relevant national and international AI governance strategies released up to 21 May 2025, by consulting AI-policy collections such as the OECD AI Policy Observatory and the relevant UNDP digital-governance document databases. These strategies were included because they explicitly address AI governance at the national or international level and set out governance objectives or implementation measures relevant to sustainability. Based on the policy documents included in this study, the analysis yields a corpus of 31 national and international AI governance strategies. This paper does not include other country-level AI policies, schemes and initiatives.

The paper will also survey secondary sources, comprising research articles and policy briefs by established researchers, together with policy reports to offer a clearer picture of recent trends and developments in this field.

Concepts

As a governance framework, AI governance first emerged in 2019 with the OECD Council Recommendation on Artificial Intelligence, adopted by the Organisation for Economic Co-operation and Development. To date, no consensus has been reached on the definition of this cross-sectoral governance framework, causing ongoing governance challenges. A broad range of definitions, in certain cases, also conceptualises AI governance in terms of regulatory coordination, policy instruments, or a regulatory framework (Dafoe, 2023).

The lack of a universally accepted definition has not hindered governance actors from differentiating among procedural, normative, and institutional AI governance. Procedural AI governance comprises mechanisms that are designed for a single objective, such as AI-based decision logs and model transparency reports. These mechanisms are already widely adopted. Normative AI governance is increasingly operationalising governance functions, including auditing algorithms, sharing data, assessing risks, and ensuring compliance, while institutional AI governance is anticipated to enhance institutional capacities.

The notion of sustainability is more clearly articulated in governance scholarship. A notable contribution was the UNDP report *Governance for Sustainable Human Development* (1997), which explicitly linked governance with sustainable

development. UNDP (1997) emphasised the close relationship between governance and sustainable human development, arguing that human development cannot be sustained without good governance and that governance itself must contribute to sustainable development. This perspective highlights governance not merely as an instrument of sustainability, but also as a condition for sustaining long-term development outcomes. In contrast to AI governance, the definition of sustainability is broadly acknowledged.

Although this study focuses primarily on the governance-oriented dimension of sustainability, the concept has gradually expanded beyond environmental concerns to include institutional and governance-related considerations. This governance-oriented perspective on sustainability is also reflected in the OECD Recommendation on Artificial Intelligence (2019), which links AI governance with broader sustainable development objectives.

The justification for focusing on the governance-oriented dimension of sustainability lies in the fact that AI governance has predominantly addressed socio-economic aspects, including its influence on the global economic system, workforce transformations, as well as challenges posed by intelligent systems to social equity. Moreover, most policy frameworks, including AI governance strategies, frame the concern of sustainability from the economic and societal dimension, thereby overlooking the governance-oriented aspects of evolving systems. Whilst economic and societal dimensions certainly warrant attention, according to the *Governing with Artificial Intelligence Report* (OECD, 2025), accountability erosion and other governance-oriented risks feature among the most pressing challenges shaping the years ahead. It is therefore important to examine the ways in which AI systems may address governance challenges and foster sustainable approaches.

Dual relationship

Scholars have begun to explore how governance mechanisms such as AI governance frameworks could be applied to promote sustainable development. One outcome of this research trajectory is the formation of sustainable AI governance, defined in this paper as “AI governance framework that guides transformation across the lifecycle of AI systems (i.e. design, development, deployment, regulation, and evaluation) towards greater institutional integrity, accountability, and digital justice”, drawing on Van Wynsberghe’s (2021) conception of Sustainable AI.

Broader scholarship further provides complementary perspectives on the sustainability of AI governance. Institutional dependency is emblematic of how AI systems rely on governance infrastructures built at significant administrative and societal cost; rather than automatically delivering sustainable governance, AI may reproduce existing inequalities and reinforce governance asymmetries over time (Crawford, 2021). Data governance processes similarly form part of broader systems of data extraction and resource concentration.

Concerns over persistent structural asymmetries, especially the concentration of technological resources among limited actors, echo political economy arguments on platform concentration and data colonialism (Couldry & Mejias, 2019). As responsible innovation scholarship urges governance actors to question not only techni-

cal performance but also the values, assumptions, and institutional choices shaping AI systems, inclusive engagement should be pivotal in translating ethical principles into sustainable governance practices. It also challenges narrow compliance-oriented governance by prioritising anticipation, inclusion, reflexivity, and responsiveness (Stilgoe et al., 2013).

The nexus between AI governance and sustainability is dual. From one perspective, AI governance can serve as a catalyst for sustainable development by, for example, strengthening accountability mechanisms and mitigating governance-related risks. This approach extends the notion of AI for sustainability to the governance domain and is referred to as AI governance for sustainability.

In examining the function of AI governance in advancing sustainability, one should give due attention not only to the subsequent phase, where well-established digital technologies are applied to support sustainability objectives, but also to the manner in which such digital technologies were initially shaped. This paper describes this second aspect as the sustainability of AI governance.

While this distinction provides an important foundation, much of the existing literature devotes considerably more attention to AI governance for sustainability than to the sustainability of AI governance itself. As a result, limited conceptual guidance exists regarding how the long-term viability of AI governance arrangements should be assessed.

To address this gap, this paper introduces governance-oriented sustainability as an analytical lens, defined as the capacity of AI governance arrangements to remain institutionally resilient, administratively viable, and accountability-preserving over time while adapting to technological change. The concept is examined through three interrelated dimensions: institutional resilience, administrative viability, and accountability integrity.

In the present study, particular attention is devoted to institutional resilience and accountability integrity, as these dimensions are most clearly reflected in China's current AI governance framework.

Governance-oriented sustainability refers to the governance-focused objective of sustaining effective AI governance systems over time. Whereas the sustainability of AI governance, which identifies the need for governance systems to remain effective over time, sustainability by integration explains how this objective can be achieved through the incorporation of sustainability considerations into governance design and implementation. However, this paper adopts the term "sustainability by integration", as it emphasises the incorporation of sustainability considerations into the design, implementation, and oversight of AI governance arrangements.

Artificial intelligence governance as an enabler of sustainability

Studies on the sustainable implementation of AI governance mechanisms have concentrated primarily on the function of intelligent systems in advancing sustainable development objectives (OECD, 2023). With only a few years remaining to attain the sustainable development goals (SDGs), AI-enabled mechanisms have strong potential to advance the attainment of multiple targets. More specifically, with regard to public-value-oriented goals, empirical evidence from 549 AI initia-

tives in European public sectors shows that AI governance has served as a catalyst for advancing key policy targets (Van Noordt et al., 2024).

Implementations of AI governance to promote sustainability are diverse. They span from algorithmic regulation and AI process automation to predictive analytics, identity analytics, and performance-monitoring applications (Wirtz et al., 2019). For example, AI governance mechanisms could be applied to monitor policy implementation. AI governance systems can likewise support institutional “smart governance solutions” (Wirtz et al., 2022) that foster governance decision-making and accountability. Within the framework of digital governance systems, AI systems may enable the integration and maintenance of digital oversight infrastructures by, for example, enhancing algorithmic transparency through automated auditing or ensuring equitable data flows through the use of integrated administrative platforms. There is a variety of emerging sustainable implementations of AI systems, including digital-oversight platforms, algorithmic-risk forecasting, performance-monitoring systems, and identity- and fraud-detection applications (Wirtz et al., 2019).

Although AI governance can function as a catalyst for transformation toward sustainability, the governance system in its current form falls short of being sustainable. Empirical evidence suggests that the deployment of algorithmic governance systems generates forms of administrative burden that correspond to the sustained organisational efforts required to implement fairness and transparency objectives (Liefgreen et al., 2024).

Similarly, algorithmic auditing in public administrations entails coordination and compliance obligations, imposing administrative burden comparable to sustaining multiple legal and regulatory requirements (Smuha, 2025). A large share of administrative workload is generated by data management units that handle compliance documentation and reporting in AI governance. The governance implications of AI systems deployment are accordingly clear. Further instances of unsustainable governance arrangements manifest as counterproductive effects of seemingly sustainable oversight mechanisms (Ingrams & Klievink, 2022). For example, an AI algorithmic mechanism may emphasise a single indicator, such as administrative burden, while overlooking or even exacerbating other risks, such as accountability deficits (Whittlestone & Clarke, 2022).

With the growing reliance on AI systems, the institutional ramifications are poised to intensify. It thus becomes critical to tackle these implications through timely response, so as to ensure that sustainability by integration serves as a core enabler of AI governance development.

Governance of AI governance sustainability

Recognising the transformative capability of AI systems, governments and global institutions have introduced governance frameworks or initiatives that can steer the development and implementation of AI systems. Conceptually, the core aim of AI governance frameworks is to establish regulations and standards and reflect societal priorities and expectations, grounded in coordination, transparency, and accountability (Chen & Ahn, 2022, pp. 426–427).

Formally endorsed in May 2019, the OECD Council Recommendation on Artificial Intelligence defines key principles for responsible governance of trustworthy AI that are intended to be implemented by all actors. These encompass, amid other key principles, inclusive growth, sustainable development and social well-being, emphasising that actors should proactively promote sustainable development and social well-being (OECD, 2019). However, the guideline offers limited guidance on sustainable integration within an AI algorithmic mechanism.

A growing wave of AI governance initiatives has emerged worldwide. In the following year, only a few technologically advanced nations, (including the United Kingdom, France, Germany, and Japan), began to draft national AI governance strategy. Most national initiatives emerged from 2018 to 2020, accompanied by a rise in academic discussions addressing emerging AI governance-oriented challenges and opportunities (Wirtz et al., 2019).

Building on Choung et al.'s multilevel governance framework (2024), this study conceptualises two dimensions linking AI governance and sustainability: the role of AI governance in advancing sustainability objectives, and the sustainability of AI governance itself. These two dimensions, viewed through national AI governance strategies, will be examined in the following discussion.

The national AI governance strategies centre on the socio-economic dimensions of sustainability. In contrast, although most countries acknowledge the relevance of AI governance to the governance dimension of sustainability, only a few move beyond declarative statements to specify how AI governance can address accountability challenges. Some countries were more explicit about how AI systems address accountability issues. The United States, for example, strives to strengthen data governance and accountability mechanisms through risk-management and governance practices (National Institute of Standards and Technology, 2023).

Notwithstanding some of the declared intentions of countries to employ AI governance to advance governance objectives, only a few countries recognise governance as one of their national strategic domains. France, by contrast, dedicates an entire section of its AI governance strategy to integrating AI systems into public governance frameworks and highlights its intent to ensure transparency, accountability, and ethical oversight of AI systems (Villani, 2018).

Government frameworks characterise sustainable AI as being closely aligned with responsible AI grounded in ethical integrity. Only a limited number of countries, such as Norway, acknowledge the importance of using big data in a governance-aligned manner, highlighting the necessity of governance-oriented maintenance of data managed by governmental, industrial, and academic actors (Norwegian Ministry of Local Government and Modernisation, 2020).

However, apart from France and Norway, few strategies acknowledge that the development of sustainable AI applications is only viable if such approaches are sustainable by integration, that is, developed through approaches that mitigate the governance-related costs associated with the development and implementation of AI systems.

Overall, international AI governance strategies show similar concerns about accountability and sustainability, but differ in how explicitly sustainability by integration is articulated.

China: the actor of AI governance sustainability

China's strategic focus on sustainable development has been maintained through successive national strategies. Its sustainability pathway originated with governance-oriented policy initiatives. In 2017, the New Generation Artificial Intelligence Development Plan established the first national governance-oriented AI framework with the intention to ensure responsible and transparent governance and to promote the efficient use of data (State Council of the People's Republic of China, 2017).

Two years afterwards, the New Generation Artificial Intelligence Governance Principles (2019) further embedded governance-oriented provisions within the framing and implementation of broader institutional frameworks (Khanal et al., 2025). Consequently, at present, China's AI governance-oriented framework covers multiple governance domains related to equitable and sustainable access to AI services, algorithmic transparency, data protection, and socially accountable innovation, among others.

Although generally regarded as well-developed, it is crucial to acknowledge that, to date, China's governance-oriented and sustainability frameworks have given only modest consideration to digital transformation. This, nevertheless, should not be taken to indicate that they are ill-suited to the digital era.

Given that most of China's sustainability and AI-governance programmes remain at an early stage of development, the next section will particularly examine the rise of integrated governance approaches.

In 2024, China introduced the "AI Capacity-Building Action Plan for Good and for All," which serves as a key component of China's policy orientation under the 2030 Agenda. From a digital perspective, the plan underscores China's commitment to explore mechanisms through which emerging technologies, such as AI systems, can optimise the effectiveness of policies aimed at mitigating governance-related risks and enhancing governance performance. Building upon this, China's Ministry of Foreign Affairs issued a policy document elaborating the role of AI governance in the Action Plan for Good and for All.

The document holds particular relevance as it outlines China's key programmes and policies that promote digitally enabled sustainable development, including the Digital China Strategy (Ministry of Foreign Affairs of the People's Republic of China, 2024). As a key component of AI governance, China's data governance framework seeks to contribute to building a more unified data architecture that helps mitigate emerging governance risks (Borgogno & Savini Zangrandi, 2024). The study also draws attention to the international landscape, noting persistent disparities in AI capacity and digital infrastructure across countries. Among other aspects, it advises that China strengthens international AI capacity-building cooperation, and urges the country to extend capacity-building support to developing countries with limited capacity (Ministry of Foreign Affairs of the People's Republic of China, 2024).

The "Ethical Norms for New Generation Artificial Intelligence" likewise highlights the importance of sustainable AI governance. Consistent with China's AI governance principles of fairness and risk mitigation, the Norms promote "human well-

being,” “fairness and justice,” and the “sustainable development” of society, while reinforcing accountability throughout the AI lifecycle (Ministry of Science and Technology of the People’s Republic of China, 2021).

In 2023, the Cyberspace Administration of China released a draft of the “Interim Measures for the Administration of Generative Artificial Intelligence Services,” where it clearly underscores that a robust level of governance-oriented safeguards should be factored into assessing the potential of AI systems to pose risks to administrative integrity and public accountability (Cyberspace Administration of China, 2023). The measures also urge providers of AI systems under different regulatory categories to introduce measures for the development and application of such systems that would maintain alignment with governance-oriented sustainability (Cyberspace Administration of China, 2023).

The way forward – China to lead by example on AI governance

The above assessment of China’s policies indicates that sustainability and governance-oriented concerns have become central priorities on the governance agenda. China’s experience also opens the door to an important conversation about what sustainability by integration truly means in practice. This study situates China’s AI governance within an institutional continuum, intersecting policy development with sustainability and accountability. It argues that China’s AI governance does not mark a radical break from earlier governance efforts but rather extends and strengthens existing patterns of institutional development. In particular, China’s emphasis on embedding sustainability into AI governance through long-term policy planning not only resonates with emerging discussions within AI governance scholarship, but also encourages policymakers to reconsider the broader implications of sustainable AI governance through an integrated lens. Although China’s policies on AI governance and sustainability remain in their early stages, they are nevertheless appropriate given that AI development is still at a relatively nascent phase. This forward-looking strategy is consistent with China’s agenda to govern and promote “innovation-driven development” (United Nations China, 2025). China’s approach is supported by its long-term policy planning and capacity to coordinate AI governance objectives with broader national development priorities, enabling sustainability considerations to be incorporated across multiple stages of AI governance. Put differently, by embedding sustainability considerations into AI governance, China seeks to incorporate inclusion-focused principles in the integration and implementation of AI systems. In contrast, efforts beyond China remain rather limited and seldom exhibit integrated strategies for the sustainability of AI governance. Hence, an important question that arises is this: How can China’s AI governance policies be transferred to other contexts?

Leveraging its regulatory practice with national AI guidelines and as a key public-sector regulator, China can introduce measures via its existing policy instruments to ensure that AI applications are “sustainable by integration”. More concretely, like data-governance frameworks, China’s AI governance guidelines also apply to external digital actors operating in key public-service domains.

China is likewise able to draw on its participation in international forums, including the G20, the OECD and the UN, as well as bilateral cooperation, to pro-

mote the equitable development and adoption of AI. For example, China conducts bilateral AI governance dialogues with external partners, covering policy areas on algorithmic safety, data governance, privacy protection, and regulatory coordination (Ministry of Foreign Affairs, 2025), covering policy areas on algorithmic safety, data governance, privacy protection, as well as regulatory coordination. Going forward, dialogues may centre on the social impacts of AI-enabled digital technologies, such as AI systems.

China can also draw on existing cooperation platforms on digital transformation with other regional groupings, such as the China – CEEC Digital Economy Cooperation Initiative, to exchange knowledge, share practical experience, and build capacity on sustainable AI governance among industry actors, non-governmental organisations, and broader stakeholder groups.

Finally, and of particular significance, China should establish a purpose-built policy on AI governance for sustainability, comparable to regulations on administrative burden reduction and algorithmic accountability, or Artificial Intelligence Standardisation, to safeguard the sustainability of AI governance across its lifecycle.

Conclusion

This study sought to clarify sustainability challenges linked to AI systems. The key insights are outlined below. Sustainable AI governance continues to be a largely underexamined domain, with most studies centred on how to employ AI to improve governance. A comparable approach is adopted by governmental and non-state stakeholders when engaging with the interface between AI governance and sustainability. Thus, academics and policymakers should consider how the integration of AI systems can be made more sustainable.

However, even at this preliminary stage, China's approach to sustainable AI governance can be seen as comparatively far-reaching, mapping key directions and thematic domains in documents including the AI Capacity-Building Action Plan for Good and for All and China's Generative AI Measures. China's strategy is, accordingly, most closely aligned with advancing AI governance through "sustainability by integration". Finally, this paper highlights several pathways through which China's governance practices may be applied outside its domestic setting.

One major limitation of this study is its narrow scope. This paper focuses solely on China and therefore provides only a partial assessment of international policies concerning the relationship between sustainability and AI. As a result, the study did not offer a detailed analysis of governance-oriented AI frameworks that could facilitate a clearer understanding of potential cooperation areas or shared regulatory baselines.

A further limitation of the paper is that it chiefly centres on the governance-oriented dimension and therefore gives little consideration to the economic and social components of sustainability. Even so, the paper has sought to lay the groundwork with a high-level overview of the issue. The focus of the study evidently warrants further attention, and it is anticipated that this paper will act as an initial reference for future researchers who may contribute to deepening knowledge of developments in this field.

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CHANGING TRENDS IN CITIZENS' PERCEPTION OF LOCAL GOVERNMENT ACCOUNTABILITY IN VIETNAM: AN ANALYSIS OF PAPI DATA, 2011–2024

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Abstract. This paper examines long-term trends in citizens' perception of local government accountability in Vietnam from 2011 to 2024, drawing on panel data from the Provincial Governance and Public Administration Performance Index (PAPI). Using 63 provinces as the units of analysis, it explores the national trajectory of perceived accountability, regional disparities, and the roles of transparency and citizen participation in shaping accountability outcomes. Findings reveal a nonlinear pattern: improvement between 2011 and 2014, decline from 2015 to 2018 and stabilisation at lower levels after 2019. Transparency emerges as the strongest predictor of perceived accountability among the factors examined, while citizen participation contributes modestly unless supported by open information channels. The study adopts a mixed descriptive and fixed-effects panel data approach and identifies regional convergence over time, with persistent advantages in the Red River Delta and Southeast. Conceptually, it highlights a hybrid model of accountability within a single-party system, in which transparency and social feedback complement administrative oversight. These insights contribute to comparative governance scholarship and inform strategies to strengthen citizen-based accountability in transitional contexts.

Keywords: local governance, citizens' perception, accountability, transparency, citizen participation, Vietnam, PAPI, panel analysis, public administration reform.

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Introduction

Accountability is a cornerstone of good governance, underpinning legitimacy, administrative performance, and citizens' trust in public institutions (Bovens, 2007; Dubnick & Frederickson, 2010). In the context of local governance, it ensures that officials are answerable to citizens and that mechanisms exist for evaluation, justification, and corrective action when performance falls short (Schedler, 1999; Fox, 2015). Strengthening accountability therefore enhances not only institutional integrity but also citizens' willingness to engage with government (Joshi, 2017; Grindle, 2012).

In political systems undergoing reform, sustaining accountability is complex due to limited institutional capacity, hierarchical bureaucratic traditions and weak citizen oversight (Brinkerhoff, 2004; Joshi, 2017). Vietnam, operating under a single-party framework, has sought to institutionalise accountability through administrative reforms, decentralisation, and citizen participation programmes (Malesky & Schuler, 2019). Since 2009, the Provincial Governance and Public Administration Performance Index (PAPI) has provided a unique dataset capturing citizens' perceptions of local governance quality across multiple dimensions – participation, transparency, accountability, corruption control, service delivery, Environmental Governance and e-governance (Binh, 2021).

Despite extensive use of PAPI data in policy assessment, longitudinal analysis of accountability trends remains scarce. Most prior studies rely on single-year or cross-sectional approaches (Nguyen et al., 2017; Pham, 2021). This study fills that gap by examining long-term changes in local government accountability from 2011 to 2024. It addresses three research questions: (1) What are the national trends in the perception of local government accountability over time? (2) How do regional disparities evolve across six socio-economic zones? (3) What relationships exist between accountability, transparency, and citizen participation?

Literature review and theoretical framework

Conceptualising government accountability

Government accountability represents both a normative principle and a functional mechanism ensuring that public authority is exercised responsibly (Bovens, 2007; Dubnick & Frederickson, 2010). It represents an institutionalised relationship in which officials are obliged to explain, justify, and take responsibility for their actions (Mulgan, 2000). Accountability thus extends beyond hierarchical supervision to include obligations toward citizens and the public interest.

International organisations – such as the United Nations Development Programme (UNDP, 2021), the World Bank (2017) and the Organisation for Economic Co-operation and Development (OECD, 2016) – identify accountability as a fundamental pillar of good governance, vital for enhancing transparency, preventing corruption, and building citizen trust. Within local governance, accountability promotes administrative efficiency, improves service delivery, and reinforces citizens' confidence in institutions (Binh, 2025).

Forms and mechanisms of accountability at the local level

Classical models in Traditional Public Administration and New Public Management (NPM) viewed accountability primarily as a top-down relationship between superiors and subordinates or between service providers and clients. Contemporary frameworks such as Public Governance and the New Public Service highlight its multidimensional and relational nature (Frederickson, 1971; Denhardt & Denhardt, 2007). Rosenbloom et al. (2022) emphasise three interdependent dimensions – managerial, political, and legal accountability – each underpinning the integrity of public service.

At the local level, accountability operates through both institutionalised mechanisms and citizens' perceptions of responsiveness. It encompasses procedural elements, such as complaint handling and access to information, as well as relational aspects like trust and fairness (Fox, 2015; Joshi, 2017). Scholars often distinguish three main forms – vertical, horizontal, and social accountability – corresponding respectively to relationships between citizens and officials, among state institutions, and between civil society and government (Goetz & Jenkins, 2001; Bovens et al., 2014; Malesky & Schuler, 2019).

Factors influencing the implementation of accountability

The effective implementation of accountability at the local level depends on multiple interrelated factors. Key among these are transparency and access to information (CECODES et al., 2021; OECD, 2016), the responsiveness of complaint-handling mechanisms (Fox, 2015; Joshi, 2017), institutional capacity and local autonomy (Faguet, 2014; Smoke, 2015), and the extent of citizen participation and engagement (Brinkerhoff, 2004; Ackerman, 2005). Political culture, local democratic practices, and the independence of oversight institutions and the media also play important roles. Furthermore, clear legal and regulatory frameworks (Schedler, 1999; UNDP, 2021), along with advances in information technology and open data initiatives (OECD, 2019), shape how accountability is institutionalised and exercised. These elements are mutually reinforcing: transparency enables participation, participation enhances responsiveness, and institutional capacity sustains accountability mechanisms effectively and over time.

Accountability in the context of a single-party system

Although the factors influencing accountability are generally universal, their operation depends on the political and institutional context. Even within single-party systems, meaningful forms of accountability can emerge through administrative, legal, and social mechanisms (Schedler, 2013; Tsai, 2007).

In such political environments, central authorities often seek to maintain legitimacy and public trust by incorporating citizen feedback into governance processes (He & Warren, 2011).

In Vietnam, the implementation of accountability exhibits both universal and context-specific characteristics. The universal aspect lies in the combination of internal and external controls, while the context-specific aspect reflects the fact that Vietnam's political system is led and governed by a single party – the Communist Party of Vietnam (CPV) – so the extent of accountability largely depends on the Party's capacity for self-regulation as well as social oversight and monitoring.

Since the *Đổi Mới* (Renovation) period, alongside institutional development and the establishment of both internal and external, formal and informal oversight mechanisms, Vietnam has emphasised decentralisation and enhanced local autonomy, particularly through successive public administration reform programs implemented from 2001 to the present (Painter, 2008; Nguyen & van Dijk, 2020). At the same time, Vietnam has placed importance on strengthening social and citizen oversight of government activities.

Theoretical framework

The study adopts the institutional–citizen interaction framework (Fox 2015; Joshi 2017), viewing accountability as a dynamic process shaped by both top-down institutional design and bottom-up citizen engagement.

Top-down components include formal legal instruments – the Law on Access to Information (2016), the Law on the Implementation of Grassroots Democracy (2022), the Law on Local Government (2015, amended in 2019 and 2025), and PAPI-based performance monitoring – which establish procedural obligations for local officials. Bottom-up pressures encompass citizen complaints, petitions, and community monitoring that reinforce responsiveness.

Data and methodology

Data source

This study uses secondary data from the Provincial Governance and Public Administration Performance Index (PAPI) – a nationally representative annual survey jointly developed by the United Nations Development Programme (UNDP) and the Centre for Community Support and Development Studies (CECODES). PAPI has been conducted since 2009, capturing citizens' experiences and perceptions of local governance quality across all 63 provinces and centrally governed cities of Vietnam (CECODES et al., 2024).

Each year, between 13,000 and 16,000 citizens aged 18 and above are interviewed using a multistage stratified random sampling design. The PAPI questionnaire covers dimensions such as participation, transparency, accountability, control of corruption, administrative procedures, public service delivery, environmental governance and e-governance.

The database provides robust longitudinal and cross-provincial comparability, enabling analysis of both national and regional governance dynamics. This study focuses on local government accountability, measured annually from 2011 to 2024.

Earlier data (2009–2010) are excluded due to methodological revisions that hinder comparability across years (CECODES et al., 2023)¹.

Variables

Dependent variable: The dependent variable is Local Government Accountability, a composite PAPI dimension capturing citizens' assessments of: Access to local officials, Effectiveness of complaint-handling and access to Judicial Services². Each sub-dimension is standardised on a 0–10 scale, with higher scores indicating stronger perceived accountability (CECODES et al., 2024).

Independent Variables: Transparency Index (0–10): openness of local budgets, land-use planning, and public information access. Citizen Participation Index (0–10): degree of citizen engagement in local decision-making, village meetings, and elections.

Provincial GDP per capita (log): proxy for socioeconomic capacity. Urbanisation rate (%): indicator of administrative and demographic context.

Regional dummies: six socio-economic regions – Red River Delta, Northern Midlands and Mountains, Central Coast, Central Highlands, Southeast, and Mekong Delta. All continuous variables were normalised to ensure comparability across time and provinces.

Analytical design

The research design is descriptive–analytical and longitudinal, combining graphical trend analysis, correlation testing, and panel regression modelling.

Step 1: National trend analysis, average accountability scores are plotted for 2011–2024 using line and LOESS-smoothed curves to reveal broad temporal patterns.

Step 2: Regional comparison, provincial data are aggregated by region to identify spatial disparities and convergence trends across six zones.

Step 3: Correlation analysis, Pearson's correlation coefficients are calculated among accountability, transparency, and participation indices to examine associations and potential mediating effects.

Step 4: Panel regression modelling, a two-way fixed-effects model is estimated to control for unobserved, time-invariant provincial characteristics (α_i) and year-specific shocks (λ_t):

$$\text{Accountability}_{it} = \alpha_i + \lambda_t + \beta_1 X_{it} + \varepsilon_{it}$$

where α_i denotes province-specific effects, λ_t year effects, and X_{it} includes control variables such as transparency, participation, and GDP per capita.

This approach captures within-province changes over time while mitigating omitted-variable bias (Nguyen & van Dijk, 2020; Malesky & Schuler, 2019).

¹ For information related to PAPI, see: <https://papi.org.vn/eng/>. As for the PAPI report from 2011 to 2024, see: <https://papi.org.vn/bao-cai/?lang=en>.

² The assessment of access to local officials is based on indicators capturing citizens' interactions with different levels of local governance and mass organisations, including contacting village or ward leaders to resolve issues and reporting successful outcomes, contacting commune or ward officials and reporting successful outcomes, contacting mass organisation officials and reporting successful outcomes, and contacting local People's Council officials and reporting successful outcomes. The effectiveness of complaint handling is evaluated using indicators such as the submission of complaints, recommendations, or denunciations and reporting satisfactory responses. Access to judicial services is measured through indicators including trust in local courts, intention to use local courts, and intention to use non-court measures.

Data cleaning and reliability

Minor missing data (<2%) were interpolated linearly across years, preserving longitudinal continuity without distorting temporal trends.

All governance indicators were rescaled to a uniform 0–10 range.

Internal reliability tests show that the accountability sub-index maintains Cronbach’s alpha between 0.78–0.84 over time, demonstrating high consistency (CECODES et al., 2024). PAPI’s methodological rigour and large sample size ensure external validity and statistical representativeness.

Ethical considerations and limitations

All PAPI data are publicly available and anonymised; they comply with UNDP ethical standards, including informed consent and confidentiality (CECODES et al., 2022). Thus, no additional ethics approval was required for secondary data use.

Limitations include: reliance on citizens’ perceptions, which may differ from objective performance; provincial aggregation, which may obscure intra-provincial variation; and descriptive orientation, which identifies associations rather than causal mechanisms. Despite these constraints, combining 14 years of data across all provinces provides a uniquely robust empirical base for analysing accountability dynamics in Vietnam’s local governance.

Results

National trends in perceived local government accountability in Vietnam (2011–2024)

Analysis of the PAPI dataset reveals a nonlinear trajectory in local government accountability across Vietnam’s 63 provinces from 2011 to 2024.



Figure 1. Change in national perceived accountability scores (2011–2024)
Source: Author’s calculation based on PAPI data (2011–2024) (- here and below, unless otherwise specified).

Figure 1 illustrates that the national mean score of citizens' assessment of accountability rose modestly from 5.50 in 2011 to 5.73 in 2014, reflecting the early impacts of administrative reforms and citizen feedback initiatives.

However, the perception of accountability decreased significantly between 2015 and 2018 reaching a low of 4.89. This regression coincided with institutional fatigue and uneven enforcement of the Law on Access to Information (2016), as well as a national policy shift prioritising economic growth. From 2019 to 2024, the perceived level of accountability remained stable at a lower level, with the index ranging between 4.24 and 4.29, suggesting structural stagnation. Possible contributing factors include tighter administrative control during the COVID-19 pandemic, limited local autonomy, and citizens' constrained influence in decision-making (Painter, 2008; Tsai, 2007).

Overall, the pattern indicates three distinct phases: Institutional improvement (2011–2014), Decline (2015–2018), and plateau at lower levels (2019–2024). These results confirm that accountability improvements achieved through early reforms were not fully sustained over time.

Regional variations

Table 1

Average Perceived Accountability Scores by Region, 2011–2024 *Regional analysis demonstrates significant yet narrowing disparities*

Region	2011	2014	2017	2020	2023	2024
Northern Midlands and Mountainous Area	5.47	5.34	4.94	4.87	4.37	4.34
Red River Delta	5.82	5.81	4.91	4.89	4.50	4.50
North Central & Central Coastal Region	5.77	5.66	5.06	4.99	4.27	4.29
Central Highlands	5.53	5.55	4.68	4.80	4.23	4.33
Southeast	5.39	5.64	5.23	4.93	4.33	4.36
Mekong Delta	5.29	5.80	4.89	4.75	4.10	4.06

Source: Author's calculation based on PAPI data (2011–2024) (- here and below, unless otherwise specified).

During the early years (2011–2014), the Red River Delta recorded the highest perceived accountability scores (≈ 5.8), followed by the Central Coast and Southeast. By contrast, citizens in the Mekong Delta and Central Highlands reported lower but improving assessments of local governance. After 2015, public perception of accountability across all regions experienced a downward trend. By 2024, inter-regional perception gaps had narrowed: the difference between the highest perceived score (Red River Delta, 4.50) and lowest (Mekong Delta, 4.06) regions was 0.34 points, compared with 0.6 points in 2011–2014. This convergence suggests more uniform public evaluation of governance quality nationwide, albeit at a modest overall level.

Correlations between Perceived Accountability, Transparency, and Participation

Table 2

Correlations between Perceived Accountability, Transparency, and Participation, 2011–2024

Year	Accountability	Transparency	Participation
2011	5.50	5.47	5.23
2012	5.58	5.61	5.16
2013	5.65	5.80	5.14
2014	5.73	5.74	4.91
2015	5.46	5.29	4.71
2016	4.85	5.55	5.15
2017	5.02	5.68	5.18
2018	4.89	5.19	5.19
2019	4.87	5.28	4.84
2020	4.91	5.28	4.78
2021	4.29	5.19	4.71
2022	4.28	5.25	4.97
2023	4.24	5.12	4.88
2024	4.29	5.30	4.98

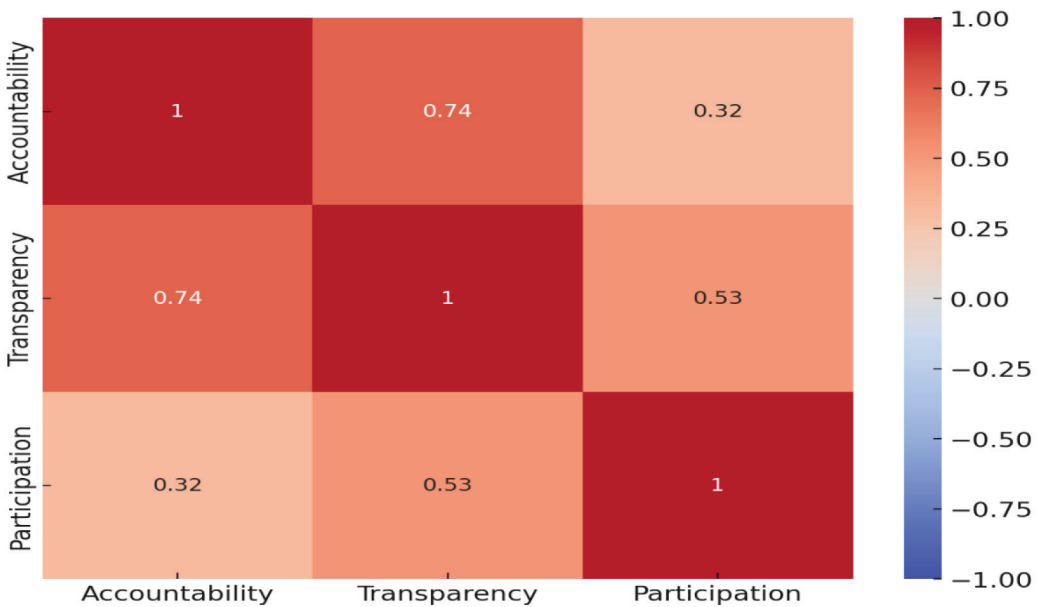


Figure 2. Correlation Map between Perceived Accountability, Transparency, and Participation (2011–2024)

Correlation analysis indicates:

Accountability–Transparency: $r = 0.74$ (strong positive).

Transparency–Participation: $r = 0.53$ (moderate).

Accountability–Participation: $r = 0.32$ (weak).

These results suggest that transparency is the central enabling factor linking participation and perceived accountability. Citizen participation alone yields limited results in improving public evaluation without open information channels and accessible feedback mechanisms.

Main regression results

To test these relationships while controlling for provincial and temporal effects, a two-way fixed-effects regression model was estimated.

Table 3

Panel fixed-effects regression results for perceived local government accountability, 2011–2024

Variable	Coefficient (β)	Std. error	p-value	Interpretation
Transparency	0.632***	0.084	<0.001	Strong positive effect
Citizen Participation	0.185**	0.071	0.011	Moderate positive effect
GDP per capita (log)	0.092	0.056	0.078	Weak positive, marginally significant
Urbanisation rate	0.036	0.042	0.210	Not significant
Regional dummy: Red River Delta	0.174**	0.065	0.007	Significantly higher accountability
Regional dummy: Southeast	0.156**	0.062	0.012	Significantly higher accountability
Constant	3.987***	0.233	<0.001	—

Note: N = 882 (63 provinces $\times$ 14 years). Model includes province and year fixed effects. R^2 (within) = 0.71. Significance levels: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Interpretation

The regression confirms that transparency is the most influential determinant of perceived local accountability. A one-unit increase in transparency is associated with a 0.63-point rise in accountability scores, controlling for socioeconomic factors.

Citizen participation also exerts a positive but weaker effect ($\beta = 0.185$, $p = 0.011$), supporting the hypothesis that participation complements rather than substitutes transparency in shaping public evaluation.

GDP per capita shows marginal significance, implying that wealthier provinces exhibit slightly stronger perceived accountability, though administrative factors are more decisive.

Regional dummies indicate that the Red River Delta and Southeast consistently outperform other regions in citizen-rated accountability – consistent with their higher administrative capacity, infrastructure, and civic engagement.

Overall, these results validate the theoretical expectation that transparency acts as both an independent and mediating variable, reinforcing the perception of accountability by empowering citizens with information and oversight leverage.

Discussion

The nonlinear trajectory of perceived accountability

The longitudinal evidence from PAPI reveals that the perception of accountability in Vietnam's local governance does not evolve linearly. Instead, it reflects a cycle of early improvement, mid-term decline, and later stagnation in public evaluation scores.

The initial improvement (2011–2014) in perceived accountability coincided with the implementation of the Law on Complaints (2011) and the Law on Citizen Reception (2013), both of which enhanced procedural access to officials and complaint mechanisms. These reforms strengthened the public perception of downward accountability by giving citizens a formal voice in administrative oversight (Schedler, 1999; Fox, 2015). However, the subsequent decline (2015–2018) signals a shift in citizen satisfaction and inconsistent enforcement of transparency laws, particularly the Law on Access to Information (2016). This period also marked a policy reorientation toward economic growth, leading to a lower public rating of governance quality. The stagnation observed after 2019 reflects structural constraints – limited autonomy, bureaucratic hierarchy and the challenges of embedding participatory mechanisms (Painter, 2008; Tsai, 2007). These findings underscore that procedural reforms alone are insufficient to sustain high levels of perceived accountability unless supported by consistent implementation, transparency, and citizen empowerment.

Regional variations and convergence in perceived accountability

Regional analysis confirms that the perception of accountability remains uneven but converging. Provinces in the Red River Delta and Southeast consistently receive higher public ratings than others, likely due to stronger administrative capacity, economic resources, and more active civic participation. In contrast, citizens in the Mekong Delta and Central Highlands reported more enduring challenges related to limited institutional capacity and citizen engagement. The narrowing of these regional perception gaps suggests a gradual diffusion of governance practices across provinces – possibly through interprovincial benchmarking and peer learning facilitated by PAPI's public reporting (Malesky & Schuler, 2019). This process aligns with theories of “soft accountability,” where reputational pressure motivates behavioral adaptation, thereby influencing public evaluations even without formal sanctions (He & Warren, 2011).

Transparency as a structural enabler of perceived accountability

This confirms Fox's (2015) argument that transparency functions as an enabling condition for social accountability – it transforms citizen feedback into perceived actionable pressure. Participation without transparency, by contrast, remains symbolic, as citizens cannot meaningfully evaluate or contest decisions.

The strong coefficient for transparency ($\beta = 0.632$) highlights that information accessibility is not just complementary but foundational to the perception of accountability. These findings reinforce the UNDP (2021) and OECD (2016) positions that open government data and citizen access to information form the institutional core of positive public evaluations of effective governance.

Citizen participation: complementary but insufficient

While citizen participation shows a positive relationship with perceived accountability, its weaker effect ($\beta = 0.185$) indicates that engagement alone cannot significantly shift public evaluation of systemic change. In single-party systems, participation mechanisms – such as village meetings, consultations, and elections – often operate within administrative rather than competitive political settings (Nguyen & van Dijk, 2020). Thus, participation enhances the perception of accountability only when linked with enforceable feedback loops. Transparency enables those loops by allowing citizens to verify official actions, while complaint-handling mechanisms institutionalise response obligations (Fox 2015). The study therefore supports a triangular model: transparency → enables → participation → reinforces → perceived accountability.

The hybrid accountability model in a single-party system

Vietnam's case illustrates a distinctive hybrid accountability model – combining hierarchical supervision (upward accountability) with social and administrative oversight (perceived downward accountability).

In this hybrid framework: Upward accountability operates through internal monitoring, disciplinary regulations, and performance evaluations by central authorities. Downward accountability functions via citizen complaints, public evaluations through PAPI surveys, and the media's monitoring role.

The data suggests that this interaction creates a feedback loop that partially compensates for the lack of electoral competition by enhancing citizens' perception of government responsiveness (Schedler, 2013; Tsai, 2007). This model illustrates Fox's (2015) perspective, emphasising the importance of information disclosure, transparency, and enhanced citizen oversight in strengthening the perception of accountability in single-party political systems.

Comparative implications

Comparative perspectives reinforce Vietnam's intermediate position between China and Indonesia. Both correlation and regression analyses identify transparency as the central determinant of accountability. Provinces with greater openness in budgets, land use, and administrative information consistently exhibit higher accountability.

In China, accountability is primarily bureaucratic, linked to career incentives and administrative evaluations (He & Warren, 2011). In Indonesia, democratic decentralisation enables stronger participatory channels, but implementation remains uneven across regions (Faguet, 2014; Joshi, 2017). Vietnam combines both approaches, integrating hierarchical oversight within the administrative apparatus with elements of democratic decentralisation.

Conclusion and policy implications

This study examined long-term trends in perceived local government accountability in Vietnam from 2011 to 2024 using panel data from the Provincial Governance and Public Administration Performance Index (PAPI).

The findings demonstrate that public evaluation of accountability has evolved nonlinearly: initial progress driven by administrative reforms (2011–2014) was followed by decline (2015–2018) and subsequent stagnation (2019–2024).

Despite formal institutionalisation through laws on complaints and information access, the perception of accountability remains largely procedural and uneven across regions.

Key findings

Transparency is the strongest determinant of accountability among those reviewed, confirming that open information enables effective monitoring and sanctions.

Citizen participation enhances perceived accountability only when supported by transparency and institutional responsiveness.

Regional disparities in public evaluations persist but have narrowed, indicating a perceived convergence in administrative practices.

The Vietnamese case reveals a hybrid model of accountability in a single-party context, combining upward administrative oversight with downward social feedback mechanisms as reflected in PAPI scores.

Policy implications

Several policy recommendations arise from these findings to further improve perceived local governance:

Strengthen complaint-handling institutions: Standardising grievance resolution procedures and improving responsiveness can significantly enhance public perception of downward accountability.

Synchronise oversight mechanisms: Coordination between party control, state audit, legislative oversight, and judicial review should form a coherent accountability system that is visible and accessible to citizens.

Promote transparency through digital governance: Expanding open data portals and e-government tools can institutionalise transparency beyond formal compliance, making information more verifiable for the public.

Enhance citizen participation through feedback integration: Local governments should institutionalise citizen feedback from PAPI and other surveys into annual planning and evaluation processes to close the gap between policy and public perception.

Advance decentralisation with clear accountability lines: Delegating authority must be accompanied by measurable performance obligations and transparent reporting to ensure citizens can monitor local outcomes.

Strengthen public service ethics: Embedding accountability in civil service evaluation and training ensures integrity-based performance, thereby fostering public trust.

Target lagging regions: Tailored administrative capacity-building and digital inclusion initiatives are needed for the Mekong Delta and Central Highlands to improve citizen-rated governance scores.

Theoretical and comparative contributions

The study contributes to comparative governance theory by showing that the perception of accountability can emerge outside competitive democracy when transparency and feedback mechanisms are institutionalised.

Vietnam's hybrid model bridges hierarchical and participatory accountability, offering insights for other developing or transitional countries on how public evaluation can be leveraged to drive administrative responsiveness.

It also demonstrates how longitudinal citizen-based data can be used to monitor governance trajectories and identify structural constraints as viewed through the lens of the governed over time.

Future research

Future studies could employ mixed-method approaches to explore micro-level accountability practices, such as how complaints are processed and resolved at commune and district levels, providing deeper qualitative insights into citizen-government interactions.

Comparative analyses with other single-party systems (China, Laos, Cuba) could shed light on how perceived social accountability mechanisms operate within the context of a party-led political system.

Panel econometric models incorporating leadership turnover, digital governance adoption, and anti-corruption enforcement would help better isolate the causal effects on perceived accountability scores over time.

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SUPPLIER SELECTION AND MUNICIPAL CORRUPTION IN PERU

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Abstract. This study examines the impact of anti-corruption practices on transparency and efficiency in supplier selection in San Ignacio city in 2023, contributing to Sustainable Development Goal (SDG) No. 8: Decent Work and Economic Growth. The research followed a quantitative, descriptive, and correlational approach with a non-experimental design. An initial sample of 269 adult residents of the city of San Ignacio was selected through non-probability convenience sampling, of which 200 were included in the final analysis after data screening. Exploratory factor analysis identified two main dimensions of anti-corruption efforts: prevention and sanction, both showing a significant relationship with transparency in supplier selection.

The findings highlight that preventive and punitive measures enhance ethical management and efficiency in public resource administration. However, the specific context of the municipality limits the generalisability of the results, suggesting the need for comparative studies in other regions. From a practical perspective, the results can guide public policy formulation aimed at strengthening transparency and ethics in government procurement processes. Furthermore, this research underscores the importance of public management based on ethics, accountability, and transparency, key elements for efficient governance and sustainable economic development. The use of advanced statistical techniques provides a robust empirical basis for improving public resource management and mitigating risks associated with corruption in government procurement processes

Keywords: Anti-corruption prevention, public procurement, transparency, public administration, public management, administrative accountability.

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Introduction

Supplier selection is a crucial topic in management due to its significant impact on operational efficiency. Choosing suitable suppliers ensures quality and reliability of inputs, contributing to cost reduction and enhancing competitiveness. Moreover, efficient supply chain (SC) management through strategic supplier selection can minimise risks such as delivery delays, price fluctuations, and quality issues (Changalima et al., 2022). Studying supplier selection is essential as it influences SC sustainability, enhancing corporate reputation and environmental performance. Proper sustainability management can mitigate reputational and regulatory risks while offering a competitive edge by meeting the demand for responsible products. It can also reduce operational costs, such as energy consumption and waste generation, by integrating sustainable practices throughout the supply chain (Patil et al., 2022).

In Colombia, supplier selection faces challenges due to complex legal requirements and a lack of trained personnel to evaluate bids effectively. This discourages many suppliers from participating and fosters corrupt and opportunistic practices. A plurality of offers does not guarantee transparency or efficiency, impacting the quality of procured goods and services and the effectiveness of public policies (Díaz, 2022).

In Chile, public procurement supplier selection encounters significant challenges due to low bidder participation, leading to many tenders being declared void. This results from restrictive bidding conditions that act as entry barriers. The lack of competitors forces the state to resort to direct contracting or private tenders with minimal competition, increasing the risk of collusion among firms. This context affects process transparency and raises public procurement costs (Bolívar-Gacitúa, 2023).

In Peru, supplier selection in public institutions faces challenges such as the lack of differentiation regarding economic sustainability, product lifespan, and maintenance costs. This underscores the need to provide solutions with low maintenance costs and long lifespans. The Analytic-Hierarchy Process (AHP) method has proven effective in identifying and prioritising these critical factors, improving decision-making and ensuring that selected suppliers align with the organisation’s sustainability and efficiency objectives (Salazar, 2023).

In Peru, the “Vacuna-gate” scandal revealed that high-ranking officials, including former President Martín Vizcarra, clandestinely accessed COVID-19 vaccines before public availability. This incident heightened perceptions of corruption and reduced support for the political system, although it did not directly affect support for democracy. Corruption in this context erodes government legitimacy and may foster support for authoritarian or ineffective leaders (Castorena et al., 2024).

The organisation analysed operates nationally within the public sector, providing services to citizens. It is based in the city of San Ignacio, in the department of Ca-

jamarca. It employs permanent staff who carry out regular duties at the entity's headquarters. The organisation faces challenges in supplier selection, leading to a negative perception of its management.

San Ignacio city was selected as a case study due to it being representative of the challenges faced by Peruvian local governments in combatting corruption. According to the Ombudsman's Office (Defensoría del Pueblo, 2025), Cajamarca registered 204 corruption cases during the second half of 2024, with municipalities being the most affected entities, accounting for 51% of regional cases. Nationally, municipalities account for 37% of all corruption cases (2,271 out of 6,152), making them the most vulnerable public institutions. Furthermore, the crimes of incompatible negotiation and embezzlement both directly related to public procurement represent over 43% of corruption cases nationwide. These statistics underscore the academic and practical relevance of examining anti-corruption practices in municipal supplier selection processes, as findings from San Ignacio may inform policy interventions applicable to similar local governments across Peru and other developing countries.

The causes of problems in public procurement supplier selection include the failure to publish tenders and the use of non-open procedures, which reduces competition and increases the risk of corruption. Short submission periods can foster unfair competition, while longer periods may indicate favouritism towards a single bidder. Additionally, the concentration of expenditure among a few suppliers and the registration of suppliers in jurisdictions with limited banking and business transparency also facilitate corrupt practices (Abdou et al., 2022).

Corruption in public procurement includes bid manipulation and bribes to inflate reported quality, reducing infrastructure quality and public welfare. In the European Union, this results in significant losses and distorts competition. The lack of competition and non-open procedures facilitate corruption. Implementing electronic procurement systems can mitigate these risks, but their effectiveness varies across countries. In summary, corruption in public procurement leads to inefficient resource use and undermines trust in institutions, requiring comprehensive measures to improve transparency and reduce discretion (Dastidar & Jain, 2023).

Failure to conduct an adequate study of supplier selection can result in acquiring low-quality materials and services, increasing operational costs and affecting the quality of goods and customer satisfaction. Additionally, dependence on a limited number of suppliers can cause supply disruptions and limit negotiating power, reducing the company's competitiveness. In summary, this compromises SC resilience and sustainability, affecting responsiveness to market fluctuations and customer needs (Hsueh et al., 2020).

Failing to adequately address corruption in public procurement in Peru has severe consequences, including distorting fair competition and awarding contracts to less qualified companies. This results in lower-quality products and services at inflated prices, negatively affecting the state budget and public trust in government institutions. The lack of effective control and transparency mechanisms allows these corrupt practices to persist, compromising the efficiency of public spending and the quality of services delivered to citizens (Dávid-Barrett & Fazekas, 2020).

This research aligns with Sustainable Development Goal No. 8: Decent Work and Economic Growth. This goal seeks to promote sustainable economic, social,

and technological development while ensuring environmental balance. Preventing corruption in public procurement contributes directly to these aims: it channels public resources towards productive investment rather than illicit gains, safeguards fair competition among local suppliers – many of them micro and small enterprises that constitute a major source of employment in regions such as Cajamarca – and strengthens the institutional trust required for sustained and inclusive economic growth (SDG target 8.3). In this way, procurement integrity operates as an enabling condition for the broader economic, social, and institutional objectives embedded in the 2030 Agenda.

The research problem is formulated through the following question: How does the fight against corruption relate to supplier selection in a municipality in the city of San Ignacio in 2023?

The practical justification is supported by the data collected to optimise the procurement process by proposing improvements in supplier evaluation and management procedures, contributing to more effective management within the procurement department. The theoretical justification aims to strengthen the field of research globally through the application of relevant theories and approaches to the studied variables, becoming a valuable reference resource for future studies. Likewise, the methodological justification lies in the fact that the data obtained through collection and evaluation will enable an in-depth analysis of the results, facilitating a detailed examination of the variables and dimensions addressed in this study. The general objective is to determine the relationship between the fight against corruption and supplier selection in the municipality of San Ignacio in 2023. Additionally, the following specific objectives were proposed: to identify the factor structure of the variable “fight against corruption” through factor analysis to determine the underlying dimensions characterising this construct in the context of supplier selection in San Ignacio city in 2023, to analyse the relationship between the fight against corruption and supplier selection in San Ignacio city in 2023, and to determine the correlation between the dimensions of the fight against corruption and supplier selection in San Ignacio city.

According to Freundt-Thurne et al. (2020), corruption is a deeply rooted concept from a socio-cultural perspective, extending its understanding by associating it with excessive and dishonest behaviours. These behaviours not only violate explicit norms but also transgress implicit norms deeply embedded in society. On the other hand, Ocampo-Murillo and Quintero-Garzón (2020) state that supplier selection is an essential practice for all companies, as they rely on various materials and services to function efficiently. This selection has a direct impact on the final product’s quality and its competitiveness in the market. Therefore, choosing the right suppliers is crucial to ensuring both product excellence and a competitive market advantage. Ozturk (2021) explains the Resource Dependence Theory as a framework highlighting the importance of strategic relationships between organisations and their external environments. This theory posits that entities depend on essential external resources for survival and success, creating interdependencies and vulnerabilities that must be strategically managed to ensure continuous access to these resources. Additionally, it suggests that organisations can reduce their dependencies and manage uncertainty by developing strategies and alliances that decrease the power of external suppliers of critical resources.

The general hypothesis of this research is: Anti-corruption practices comprising both preventive mechanisms and control-sanction measures have a significant positive relationship with transparency and efficiency in supplier selection processes. This relationship is expected to be stronger in the planning and selection phases, where institutional controls can effectively mitigate corruption risks. If confirmed, this pattern would suggest that strengthening anti-corruption frameworks in municipal procurement could serve as a replicable strategy for improving public resource management across similar local governments in developing countries.

Methodology

The research methodology followed a scientific approach as highlighted by Diaz Sanchez (2023), who emphasised that scientific research drives knowledge by generating new ideas and approaches while addressing key challenges faced by researchers. In this study, a quantitative perspective was adopted to examine the relationship between quantified variables (Serra-Aracil et al, 2022). This approach builds on scientific knowledge and uses methodologies, protocols, and technologies to meet an identified need (Ley No. 31250, 2021). The research level was descriptive and correlational, which are essential steps in quantitative research. Researchers typically conducted an exploratory or qualitative study before reaching this level (Ochoa & Yunkor, 2019). Fernández-Vigo et al. (2023) emphasised that knowledge acquisition through research involves developing and integrating investigative, development, and execution stages while comprehending the services or goods generated during the research process. This study was designed with a non-experimental and cross-sectional approach, as data from both variables were collected only once (Idrogo Zamora et al., 2021). The population, as defined by Santarrone (2023), referred to the complete set of measurements, whether repetitive or unique, performed under real or theoretical conditions, used to analyse a specific quality. These measurements were conducted across all elements possessing the characteristic in question, using a predefined scale with a rigorous definition of time and space. The initial sample was non-probabilistic and convenience-based, consisting of 269 adult residents of San Ignacio city in 2023. After data screening for univariate and multivariate outliers, the final sample included 200 participants. Inclusion criteria for the study comprised adult residents of San Ignacio city with knowledge of public management, preferably professionals currently working in other state entities, who had access to digital platforms and were familiar with municipal services. Exclusion criteria included minors, non-residents of San Ignacio, current personnel of San Ignacio (to preserve an external-observer perspective), and individuals without access to the digital platform required for survey administration. The unit of analysis was the adult resident of San Ignacio city in 2023. Data collection required structured procedures to gather appropriate and relevant information for this thesis. Santarrone (2023) defines a data collection instrument as a tool facilitating data acquisition and highlights three essential conditions for its effectiveness: reliability, validity, and impartiality. The selected data collection technique was a survey administered to residents of San Ignacio city in 2023, complemented by document analysis. Data were obtained through specifically designed

questionnaires to organise information systematically. A registration form was also used to analyse documents such as reports and other relevant materials. The questionnaire's validation was conducted through expert judgment, a common research process involving three specialists responsible for evaluating the instrument's suitability and relevance. Regarding reliability, it refers to the questionnaire's and data collection procedures' abilities to provide consistent and predictable results over time and under different conditions. The instrument underwent a purification process through exploratory and confirmatory factor analysis, resulting in a final version of 13 items (6 items for Institutional Corruption Prevention and 7 items for Anti-Corruption Control and Sanction). Cronbach's alpha coefficients for the final instrument are presented in Table 1.

Table 1

Cronbach's Alpha coefficient for the questionnaire

Instrument	Cronbach's alpha	Consistency level
Fight Against Corruption	0.821	Good
Supplier Selection	0.797	Acceptable

Source: Compiled by the author (- hereinafter, unless otherwise indicated).

The questionnaire was administered to participants through Google Forms, with schedules coordinated based on each participant's availability and prior consent. Collected data were manually entered into Excel to build a database, later analysed using SPSS version 27 and the Amos programme to generate research results. Data analysis included both descriptive and inferential statistics to conduct hypothesis testing, supported by various graphs for proper interpretation. This process was complemented by basic functions of the Microsoft Office suite. Regarding ethical considerations, this study adhered to established principles of research integrity. Informed consent was obtained from all participants prior to data collection, ensuring voluntary participation and confidentiality. Authorisation from the municipality of San Ignacio was obtained to access the necessary information. The research complied with ethical standards for social science research, including respect for authorship rights, avoidance of plagiarism, and proper source citation. All presented content is original, and participants' anonymity was preserved throughout the study.

Data Availability Statement. The anonymised dataset supporting the findings of this study, together with the analysis outputs (exploratory and confirmatory factor analyses, reliability indices, and correlation matrices), is available from the corresponding author upon reasonable request.

Results

To evaluate normality in a large population, the Kolmogorov-Smirnov test was applied. This test helps identify deviations from the normal distribution, facilitating the selection of appropriate statistical methods for further analysis.

Table 2

Kolmogorov-Smirnov normality test

Variables	Statistic (D)	df	Sig. (two-tailed)
Fight Against Corruption	0.097	200	0.000
Supplier Selection	0.087	200	0.001

Note: D = Kolmogorov-Smirnov test statistic;

df = degrees of freedom (sample size);

Sig. = two-tailed significance level (p-value). Sig. values displayed as .000 indicate $p < .001$.

The Kolmogorov-Smirnov results indicate that both variables deviate from normality ($p < 0.05$), suggesting the use of Spearman's correlation for analysis, as it is suitable for non-normal data.

Regarding the general objective: Determine the relationship between the fight against corruption and supplier selection in San Ignacio, 2023.

Table 3

Relationship between fight against corruption and supplier selection

		V1. Fight Against Corruption	V2. Supplier Selection
V1. Fight against corruption	Spearman's correlation	1.000	0.880 *
	Sig. (two-tailed)		0.000
	N		200
V2. Supplier selection	Spearman's correlation	0.880*	1.000
	Sig. (two-tailed)	0.000	
	N	200	

Note: * $p < .001$

The Spearman's correlation results show a strong positive relationship between the variables *Fight Against Corruption* and *Supplier Selection*, with a correlation coefficient of 0.880. This correlation is significant ($p < 0.05$), indicating that as one variable increases, the other tends to increase as well. This finding suggests a consistent connection between the two variables, highlighting their interdependence within the analysed context.

Regarding the specific objective of identifying the factorial structure of the variable *Fight Against Corruption* through factor analysis, the goal was to determine the underlying dimensions characterising this construct in the context of supplier selection in the municipality of San Ignacio, 2023.

The questionnaire used to evaluate the *Fight Against Corruption* variable was based on Peru's National Integrity and Anti-Corruption Plan 2018–2021, which establishes public policies to strengthen ethics and transparency in public administration. This plan underscores the importance of an efficient and transparent state acting

based on accountability and meritocracy. Additionally, it highlights the role of the High-Level Anti-Corruption Commission (CAN), responsible for coordinating anti-corruption prevention and sanction policies across all levels of government (Presidency of the Council of Ministers [PCM], 2018). Guided by these principles, the instrument was designed to measure the dimensions of Institutional Corruption Prevention and Anti-Corruption Control and Sanction in supplier selection.

The initial questionnaire consisted of 20 items distributed into two dimensions: Institutional Corruption Prevention and Anti-Corruption Control and Sanction, with 10 items per dimension evaluated on a Likert scale measuring agreement or disagreement levels. This structure aimed to capture both preventive and corrective mechanisms within the context of fighting corruption in a public entity.

During the first phase, an exploratory factor analysis (EFA) was conducted to simplify and improve the instrument's consistency. The initial sample included 269 respondents, with 29 univariate outliers removed through boxplot analysis, resulting in $N=240$ for the preliminary EFA. Subsequently, for the confirmatory factor analysis (CFA), multivariate normality was assessed using Mahalanobis distance ($p < .001$), eliminating 40 additional cases that presented multivariate outliers, obtaining a final sample of $N=200$ for all subsequent analyses. This data screening was necessary to meet the normality assumptions required by the maximum likelihood estimation method (Byrne, 2016; Kline, 2016). Individual items were evaluated using item-total correlation indices. Only items with a correlation level above 0.30 were retained, ensuring adequate discriminative capacity. As a result, items 1, 2, 14, and 20 were removed. Following the CFA, items 9, 10, and 17 were also removed to enhance model goodness-of-fit indices, resulting in a final instrument of 13 items. The reliability of this final instrument was confirmed with adequate Cronbach's alpha coefficients, as reported in Table 1 (Methodology section).

For the EFA, the maximum likelihood method with Varimax rotation and Kaiser normalisation was used to identify underlying dimensions in the data and optimise item grouping into specific factors. The Scree Plot initially suggested retaining three factors; however, after theoretical review, only two factors were kept for greater conceptual coherence. The sampling adequacy measure KMO was 0.864, and Bartlett's test of sphericity with a chi-square statistic ($\chi^2 = 1304.853$, $p < .001$) confirmed the model's suitability. These results indicate that the sample size and inter-item correlations are sufficient to justify using EFA in this study.

Following the EFA, a confirmatory factor analysis (CFA) was performed to validate the obtained structure and improve model fit indices. During this phase, items 9, 10, and 17 were removed to enhance model goodness-of-fit indices, resulting in a more precise and consistent factorial structure.

The final model includes six items for *Institutional Corruption Prevention* (items 3, 4, 5, 6, 7, and 8) and seven items for *Anti-Corruption Control and Sanction* (items 11, 12, 13, 15, 16, 18, and 19) (the wording of each item is summarised in Table 5). Each item demonstrates a factor loading above the minimum threshold of 0.40, indicating significant contributions to the construct's measurement. The correlation between the factors *Institutional Corruption Prevention* and *Anti-Corruption Control and Sanction* is 0.08, suggesting a low relationship between these dimensions while maintaining sufficient differentiation to justify analysing them as separate factors.

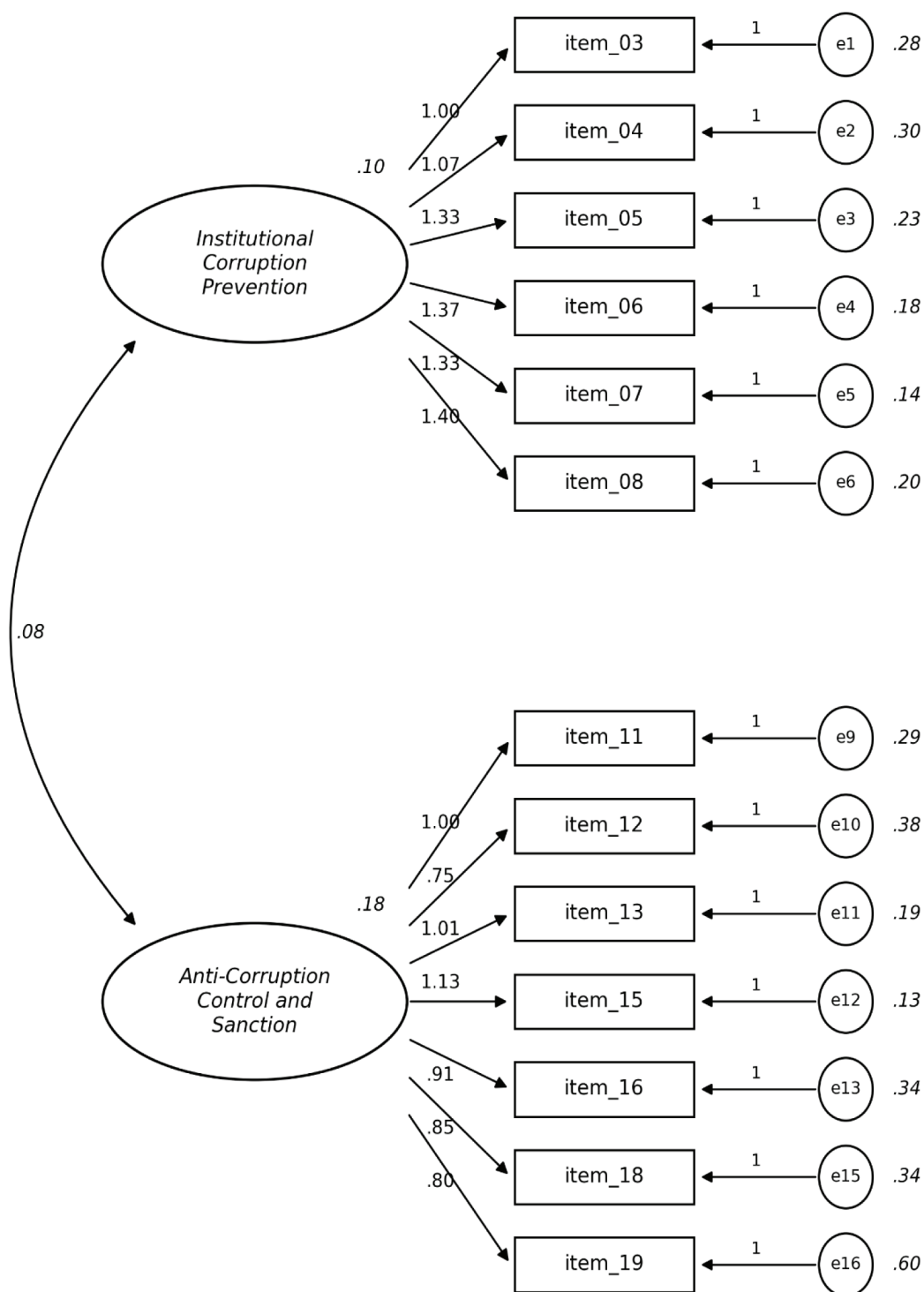


Figure 1: Factorial structure of the variable “Fight against corruption” through factor analysis

The fit indices of the final model were satisfactory, indicating a good representation of the observed data:

Table 4

Model fit indices

Index	Value	Interpretation
GFI (Goodness of Fit Index)	0.944	Indicates a good fit between the model and the observed data
AGFI (Adjusted Goodness of Fit Index)	0.920	Falls within the expected range, suggesting an adequate fit
RMR (Root Mean Square Residual)	0.022	Close to zero, indicating low residual discrepancy
RMSEA (Root Mean Square Error of Approximation)	0.037	Reflects excellent fit, with a confidence interval (CI) of 0.000 to 0.059
CFI (Comparative Fit Index)	0.976	Demonstrates a high level of comparative model fit
NFI (Normed Fit Index)	0.898	Indicates an acceptable fit supporting the validity of the model

The goodness-of-fit indices confirm that the factorial model represents the observed data well. The GFI (0.944), AGFI (0.920), CFI (0.976), and NFI (0.898) values, all close to 1, indicate that the model adequately fits and captures the relationships between the items, supporting its theoretical validity. This fit ensures that the identified factor structure aligns coherently with the data.

Additionally, the RMR (0.022) and RMSEA (0.037) indices, both close to zero, demonstrate low discrepancies between the predicted and observed correlations, indicating that the model accurately represents the data. This guarantees that the model is not only theoretically robust but also empirically reliable, offering a valid and consistent factorial structure for the study.

Table 5

Goodness indices

Dimension	Item	Item description (abridged)	Factor loading	Error
Institutional corruption prevention	Item 03	Sufficiency and effectiveness of anti-corruption training	1.00	0.28
	Item 04	Active promotion of ethical values across operations	1.07	0.29
	Item 05	Corruption prevention as an institutional priority	1.33	0.28
	Item 06	Clear rules for preventing corruption in daily activities	1.37	0.28
	Item 07	Communication of anti-corruption prevention policies	1.33	0.29
	Item 08	Regular review and updating of prevention practices	1.40	0.28

Dimension	Item	Item description (abridged)	Factor loading	Error
Anti-Corruption Control and Sanction	Item 11	Effectiveness of sanctions in deterring corrupt behaviour	1.00	0.29
	Item 12	Clear information on sanctions applicable to corruption	0.75	0.34
	Item 13	Perceived security when using reporting channels	1.01	0.34
	Item 15	Effectiveness of supervision in preventing corruption	1.13	0.29
	Item 16	Awareness of sanctions for corruption	0.91	0.28
	Item 18	Thorough investigation of corruption reports	0.85	0.34
	Item 19	Impartial application of sanctions	0.80	0.30

The factor loadings of the items for each dimension exceed the threshold of 0.40, confirming that the items significantly contribute to measuring their respective dimensions. The associated errors for each item are low, suggesting an acceptable level of precision in the factor loading estimates.

Furthermore, the correlation between the two dimensions, *Institutional Corruption Prevention* and *Anti-Corruption Control and Sanction*, is 0.08, indicating a low relationship between the dimensions. This validates their consideration as separate factors in the model.

For specific objective three: To analyse the relationship between Fight Against Corruption and Supplier Selection in the municipality of San Ignacio in 2023.

Table 6

Analysis of the fight against corruption and supplier selection

Dimension of analysis	Specific aspect	Document source (report and year)	Description/ observation	Conclusions
Selection processes	Tenders and awards	Report No. 016-2024-CG/GRCA (2024)	Review of selection procedures used to ensure compliance and transparency	It is necessary to strengthen transparency and ensure open and well-documented tenders
	Supplier documentation	Selection Report No. 223-2023-MPSI (2023)	Evaluation of supplier requirements and suitability documentation	It is recommended to improve supplier documentation to ensure legal compliance
Planning and execution	Requirement specification	Planning and Contract File	Analysis of how requirements are formulated and detailed in initial contract phases	Requirement specifications should be clearer and more detailed to avoid interpretation issues
	Justification for supplier selection	Award Report No. 047-2024-OCI (2024)	Evaluation of criteria and justifications used for supplier selection	Clear and objective criteria should be defined to ensure impartiality in supplier selection

Dimension of analysis	Specific aspect	Document source (report and year)	Description/ observation	Conclusions
Transparency and compliance	Control and compliance in pre-contractual stages	Report No. 027-2024-OCI (2024)	Verification of adherence to principles of efficiency, transparency, and effectiveness	Implementing independent audits in pre-contractual stages will strengthen compliance
Irregularity management	Identification of adverse situations	Internal Control Report No. 096-2023-OCI (2023)	Review of adverse situations highlighted and recommendations issued	It is crucial for the municipality to address recommendations to prevent future irregularities
Results of concurrent and post-control	Compliance with audit recommendations	Post-Control Report No. 223-2024-OCI (2024)	Analysis of audit results and measures taken to address irregularities	Strengthening the follow-up of recommendations will reduce recurring supplier selection issues
Comparison with best practices	Alignment with public procurement standards	Comptroller Directives, Law No. 29230 and DS 210-2022-EF	Comparison of processes with international best practices in public procurement	Aligning processes with international standards will increase transparency and efficiency

The documentary analysis of supplier selection processes in San Ignacio city highlights key areas for improving transparency and control. Firstly, reports emphasise the need to enhance transparency in tendering processes and ensure that supplier documentation is complete, contributing to more reliable selection procedures. The planning and execution stages also require clear and specific selection criteria during the formulation of requirements, avoiding ambiguities that could lead to irregularities.

Furthermore, the reports recommend implementing independent audits during pre-contractual stages to strengthen regulatory compliance and ensure greater transparency. Managing irregularities is another critical aspect, with a strong emphasis on the municipality addressing internal control recommendations to prevent recurring issues and reinforce accountability in procurement processes.

Finally, aligning supplier selection processes with best practices and international standards would optimise efficiency and transparency while minimising corruption risks. In summary, enhancing documentation, regulatory control, and follow-up on recommendations would improve supplier selection processes, supporting anti-corruption objectives in public management.

The results indicate that the prevention of ethical risks in supplier selection processes is strongly associated with adequate planning (correlation of 0.774), suggesting that a well-organised structure in the initial stages significantly contributes to avoiding undesirable practices.

The selection phase also plays an important role (0.532), albeit to a lesser extent, while contractual execution shows a weaker relationship (0.328) with ethical risk prevention.

Table 7

**Relationship between the Dimensions
of the Fight Against Corruption and Supplier Selection**

		Planning and preparatory actions	Selection phase	Contractual execution
Prevention of Corruption	Spearman's correlation	0.774	0.532	0.328
	Sig. (two-tailed)	0.000	0.000	0.000
Combatting Corruption	Spearman's correlation	0.416	0.804	0.845
	Sig. (two-tailed)	0.000	0.000	0.000
N		200	200	200

Note: Sig. values displayed as .000 indicate $p < .001$.

On the other hand, the control and mitigation of ethical risks are particularly relevant in the contractual execution (0.845) and selection (0.804) phases, where active supervision and monitoring are critical to ensuring transparency. Although planning also has a positive impact on risk mitigation (0.416), direct control during the final stages of the process proves essential to maintaining high standards of integrity. Together, these findings suggest that solid planning and rigorous oversight during the selection and execution phases are key to fostering transparency and integrity in the procurement process.

Discussion

The findings of this study reveal a strong positive relationship ($r = 0.880$, $p < .001$) between anti-corruption practices and supplier selection processes in San Ignacio city, confirming the general hypothesis. This result aligns with international evidence indicating that institutional integrity mechanisms significantly influence procurement outcomes across diverse contexts.

Factorial structure of anti-corruption efforts

The exploratory factor analysis identified two distinct dimensions of anti-corruption efforts: Institutional Prevention and Control-Sanction. This dual structure is consistent with the theoretical frameworks observed in international literature. Ograh et al. (2021) identified 31 drivers for integrating complex criteria into supplier selection, classifying them into categories that parallel our dimensions: "Strong Policy Direction" aligns with Institutional Prevention, while "High Level of Commitment" corresponds to Control-Sanction mechanisms. Similarly, Lopes and Rodriguez-Lopez (2021) proposed a structure of previous analysis, evaluation, and final decision that validates the independence of preventive and control measures in procurement processes.

The low correlation (0.08) between Prevention and Control-Sanction dimensions suggests they operate as complementary but distinct approaches. Caillaud and Lambert-Mogiliansky (2021) support this finding by arguing that sanctions without alert mechanisms (prevention) are ineffective because auditors lack the information to iden-

tify irregularities. This reinforces the need for comprehensive anti-corruption frameworks that address both aspects simultaneously rather than relying on a single strategy.

The strong positive correlation ($r = 0.880$) between anti-corruption measures and supplier selection quality is consistent with international evidence. Baltrunaite et al. (2021) demonstrated that institutional quality is a critical determinant of procurement efficiency in Italian municipalities, finding that when discretionary powers are expanded in environments with high corruption risk and low transparency, there is a significant increase in the selection of politically connected firms and a decline in supplier productivity. Their conclusion that “discretion is less effective when granted to public administrations that are less qualified, more opaque and more exposed to the risk of corruption” directly supports our findings.

This relationship is further validated by Peruvian evidence. Pomahuacre (2023) reported a significant correlation ($r = 0.548$, $p < 0.001$) between official corruption and public perception in the Ica municipality, while Santamaria (2022) demonstrated that corruption in public procurement is a persistent phenomenon driven by a lack of institutional ethics and ineffective jurisdictional oversight. Although our correlation is stronger (0.880 vs. 0.548), these convergences suggest that the relationship between anti-corruption efforts and administrative efficiency is a consistent pattern across Peruvian municipalities.

Zhang and Li (2022) provide additional support from the Chinese context, arguing that corruption behaviours are “tractable” and can be mitigated through precise supervision systems. Their finding that tendering accounts for up to 70% of corruption cases in public projects underscores the critical importance of anti-corruption measures specifically in supplier selection processes.

Phase-specific correlations

The differential correlations observed across procurement phases provide important insights for targeted interventions. The high correlation between Institutional Prevention and the Planning phase ($r = 0.774$) suggests that preventive controls are most effective when implemented at the early stages of procurement, where institutional oversight can establish transparent procedures before corruption opportunities emerge. Lopes and Rodriguez-Lopez (2021) reinforce this finding by emphasising that “the main stage in a supplier selection process is the definition of the evaluation criteria”, highlighting planning as the critical foundation for procurement integrity.

Conversely, Control-Sanction measures showed stronger associations with the Selection ($r = 0.804$) and Execution phases ($r = 0.845$), indicating that active monitoring becomes critical once procurement processes are underway. Caillaud and Lambert-Mogiliansky (2021) identified five phases of procurement, noting that while corruption is often “decided” in the planning phase through fine-tailored specifications, the damage materialises during selection and execution. This pattern is echoed by Santamaria (2022), who found that crimes such as embezzlement and collusion occur most frequently during the active performance of official duties in Peruvian public institutions.

Khoso et al. (2021) documented comparable phase-specific vulnerabilities in Pakistan’s public tendering system, highlighting that although prequalification processes exist during planning, “in the final award stage, quality is often ignored to focus only on price.” This international evidence supports our finding that Prevention

is stronger in Planning (0.774) but loses effectiveness compared to Control-Sanction in Selection and Execution phases.

Documentary analysis and transparency challenges

The documentary analysis revealed persistent challenges in transparency, including incomplete supplier documentation and ambiguous selection criteria. These deficiencies mirror broader patterns identified both nationally and internationally. The Peruvian Ombudsman's Office (Defensoría del Pueblo, 2025) reported that municipalities accounted for 37% of national corruption cases (2,271 out of 6,152), with incompatible negotiation and embezzlement both directly related to public procurement representing over 43% of incidents. Specifically, Cajamarca region registered 204 corruption cases during the second semester of 2024, with municipalities accounting for 51% of regional cases.

These findings align with international evidence on documentation and criteria weaknesses. Niewerth, et al. (2022) criticised that “weighting factors are commonly determined directly, i.e. percentual values are assigned intuitively by the client,” creating opportunities for manipulation. Khoso et al. (2021) similarly reported that “contractors manipulated the information on certain criteria and presented the information according to their own advantages,” while Baltrunaite et al. (2021) found that “higher discretion results in lower transparency,” with many municipalities failing to report key data on project execution.

Pomahuacre (2023) attributes these deficiencies to institutional factors, noting that “corruption is due mainly to inefficiency, lack of control mechanisms, discretion, and state monopolies.” This assessment is consistent with Santamaria's (2022) finding that “the application of control norms is still weak and incipient” in Peruvian public institutions, requiring reinforcement across state entities.

International comparative perspective

The challenges observed in San Ignacio reflect global patterns in municipal procurement. In Italy, Baltrunaite et al. (2021) found that broader bureaucratic discretion leads to “a large increase in the share of procurement contracts awarded to politically connected firms.” In China, Zhang and Li (2022) identified that corruption in bidding “is prevalent across different administrative levels,” while in Pakistan, Khoso et al. (2021) concluded that “public tendering is crowded with severe threats that may be alarming for the future of the industry.”

The European context offers additional insights. Niewerth et al. (2022) highlighted that despite the European Public Procurement Directive 2014/24/EU mandating multiple evaluation criteria, traditional formulas remain “mathematically weak and susceptible to artificial manipulation.” Caillaud and Lambert-Mogiliansky (2021) quantified the impact, noting that “social loss due to corrupt projects amounts to 29% of project value in urban utility construction and 20% in roads.”

These international comparisons underscore that the vulnerabilities identified in San Ignacio are not unique but represent systemic challenges requiring comprehensive institutional responses. As Ograh et al. (2021) observed, integrating non-traditional criteria into supplier selection is “difficult, complex, and uncertain” across diverse contexts, highlighting a global challenge in standardising ethical procurement evaluations.

Practical implications

The results suggest several practical implications for municipal governance. First, local governments in developing countries could benefit from implementing dual-track anti-corruption systems that combine robust prevention protocols during planning with rigorous oversight during execution. Caillaud and Lambert-Mogiliansky (2021) recommended Alert-Based Accountability (ABA) mechanisms where competing firms report irregularities in technical specifications a “cheap” approach that leverages market knowledge to detect favoritism.

Second, the adoption of objective evaluation tools could reduce discretionary decisions that facilitate corruption. Niewerth et al. (2022) proposed Data Envelopment Analysis (DEA) for transparent tender evaluation, while Lopes and Rodriguez-Lopez (2021) demonstrate that multi-criteria decision-making tools like PROMETHEE enhance objectivity in supplier evaluation. These methodological innovations could address the documentation and criteria standardisation issues identified in San Ignacio.

Third, strengthening ethical foundations is essential. Santamaria (2022) recommended implementing training programmes on ethical values and reinforcing internal control, while Pomahuacre (2023) advocated for Anti-Corruption Plans based on meritocracy. Ograh et al. (2021) emphasised that “formulation of policy, goals, and action plans” is the most frequently cited driver for organisational change in supplier selection practices.

Limitations and future research

Several limitations should be acknowledged. First, the study focused on a single municipality, which may limit the generalisability of findings to other contexts. Second, the cross-sectional design prevents causal inferences about the relationship between anti-corruption practices and procurement outcomes a limitation shared with comparable studies in Ica (Pomahuacre, 2023) and Callao (Santamaria, 2022). Third, the reliance on self-reported perceptions may introduce social desirability bias, as noted by Khoso et al. (2021) regarding contractor information manipulation.

Additionally, as Baltrunaite et al. (2021) observed, limited official reporting on project execution constrains comprehensive evaluation. Caillaud and Lambert-Mogiliansky (2021) further caution that even strong anti-corruption measures may be insufficient if sanctions (L) remain lower than the benefits of corrupt behaviour, suggesting the need for research on optimal penalty structures.

Future research should consider longitudinal designs and comparative studies across multiple municipalities to validate these findings and explore the causal mechanisms underlying the observed relationships. As Zhang and Li (2022) suggest, transitioning from reactive punishment to proactive prevention through data-driven profiles could represent a promising direction for municipal anti-corruption strategies in Peru and other developing countries.

Conclusions

The research demonstrated a significant relationship between anti-corruption practices and the efficiency of supplier selection in San Ignacio. Transparency and accountability measures in public procurement contribute to reducing the

risk of undesirable practices, ensuring ethical and optimised management of public resources.

The factorial analysis revealed that anti-corruption efforts in the municipality are structured around two key dimensions: institutional prevention and control and sanction. This structure highlights the importance of integrating both preventive actions and sanction mechanisms to ensure transparent and accountable administration.

The study identified deficiencies in the clarity of documentation and the uniformity of criteria applied during the planning and execution phases. The lack of clear criteria and independent audits in these stages affects transparency and efficiency in supplier selection, impacting the quality of the procurement process.

A positive correlation was found between the dimensions of prevention and control and the phases of the supplier selection process, particularly in the selection and contractual execution stages. This indicates that a robust anti-corruption approach not only promotes transparency in procurement but also ensures the selection of quality suppliers. Given that municipalities concentrate the bulk of procurement-related corruption cases in Peru, the prevention–sanction model validated in San Ignacio city is likely to be extrapolable to comparable local governments across the country and in other developing contexts, providing a replicable framework for strengthening municipal procurement integrity.

Recommendations

It is recommended that San Ignacio city implements a comprehensive anti-corruption control system across all phases of the procurement process. This system should include periodic internal and external audits to strengthen transparency and reinforce adherence to ethical principles in supplier selection. This will contribute to building trust in municipal management and promoting institutional ethics in the administration of public resources.

The city is encouraged to establish a formal prevention and sanction plan encompassing both dimensions identified in the study. This could involve developing specific protocols to guide preventive actions (such as training officials in public ethics) and defining clear sanctions for any breaches, to deter practices that may compromise transparency in procurement processes.

It is advisable for the municipality to improve the standardisation of documentation and define clear and uniform criteria for supplier selection. This can be achieved by developing a procurement procedures manual that includes detailed guidelines for each phase of the process. Additionally, it is suggested to establish independent audits during the planning and execution phases to ensure compliance with criteria and guarantee an objective and equitable process.

To maximise the benefits of anti-corruption practices in the procurement process, the municipality is advised to implement training programmes on ethics and accountability for officials responsible for supplier selection. Continuous training of this nature will enable officials to consistently apply principles of transparency and ethics in their decisions, reinforcing the municipality's commitment to integrity in its procurement processes.

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ANNEXES

Questionnaire for the variable Fight Against Corruption¹

Dear participant, this questionnaire is anonymous and is intended for adult residents of San Ignacio city. Please respond as honestly as possible. The information provided will be used solely for academic purposes, will be handled confidentially, and is anonymous. Would you like to participate as a respondent in this study?

YES ☐ NO ☐

Instructions: Read each item carefully and mark with an “X” the response option you consider appropriate.

Strongly Disagree (SD)	Disagree (D)	Neither Agree nor Disagree (NAD)	Agree (A)	Strongly Agree (SA)
1	2	3	4	5

VARIABLE 1: Corruption Prevention						
N°	ITEMS	1	2	3	4	5
<i>DIMENSION 01: Corruption Prevention</i>		1	2	3	4	5
1	I believe there are effective anti-corruption prevention policies in the institution					
2	The institution's reporting mechanisms are accessible and secure for everyone					
3	Training on anti-corruption prevention is sufficient and effective in the institution					
4	The institution actively promotes ethical values in all its operations.					
5	Corruption prevention is a priority in the institution					
6	The institution has clear rules for preventing corruption in daily activities					
7	The institution informs about its anti-corruption prevention policies					
8	The institution regularly reviews and updates its anti-corruption prevention practices					
9	In general, I believe the institution has a culture of integrity and transparency					
10	The institution ensures that all employees are aware of anti-corruption policies					

¹ Both questionnaires presented in this Annex were originally designed and administered in Spanish to adult residents of San Ignacio city. The versions presented here are English translations prepared by the authors for publication.

VARIABLE 1: Corruption Prevention						
Nº	ITEMS	1	2	3	4	5
<i>DIMENSION 02: Combatting Corruption</i>		1	2	3	4	5
11	The institution's sanctions are effective in deterring corrupt behaviours					
12	The institution clearly informs about applicable sanctions for corruption acts					
13	Employees feel secure when using reporting channels in the institution					
14	The institution's risk mitigation plans for corruption are effective					
15	Supervision in the institution is effective in preventing corruption					
16	Sanctions for corruption in the institution are well known					
17	The institution maintains an ethical and responsible work environment					
18	The institution thoroughly investigates reports of corruption					
19	Sanctions for corruption in the institution are applied impartially					
20	Employees in the institution feel supported to report acts of corruption					

Confirmatory factorial data collection instruments questionnaire for the variable Fight Against Corruption

Dear participant, this questionnaire is anonymous and is intended for adult residents of the city of San Ignacio. We kindly ask you to answer as honestly as possible. The information provided will be used solely for academic purposes, it will be handled confidentially and will remain anonymous. Would you like to participate as a respondent in this study?

YES ☐ NOT ☐

Instructions: Read each item carefully and mark with an "X" the response option you consider appropriate.

Strongly Disagree (SD)	Disagree (D)	Neither Agree nor Disagree (NAD)	Agree (A)	Strongly Agree (SA)
1	2	3	4	5

VARIABLE 1: Fight Against Corruption						
Nº	ITEMS	1	2	3	4	5
<i>DIMENSION 01: Corruption Prevention</i>		1	2	3	4	5
3	The institution's reporting mechanisms are accessible and secure for everyone					
4	The institution actively promotes ethical values in all its operations					

VARIABLE 1: Fight Against Corruption						
N°	ITEMS	1	2	3	4	5
<i>DIMENSION 01: Corruption Prevention</i>		1	2	3	4	5
5	Corruption prevention is a priority in the institution					
6	I believe there are effective anti-corruption prevention policies in the institution					
7	In general, I believe the institution has a culture of integrity and transparency					
8	The institution regularly reviews and updates its anti-corruption prevention practices					
<i>DIMENSION 02: Combatting Corruption</i>		1	2	3	4	5
11	Employees feel secure when using the institution's reporting channels					
12	The institution clearly informs about applicable sanctions for corruption acts					
13	The institution's sanctions are effective in deterring corrupt behaviours					
15	Supervision in the institution is effective in preventing corruption					
16	Sanctions for corruption in the institution are well known					
18	The institution thoroughly investigates reports of corruption					
19	Sanctions for corruption in the institution are applied impartially					

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PUBLIC POLICY FRAMEWORKS FOR PROMOTING GREEN INNOVATION: IMPLICATIONS FOR THE PERFORMANCE OF A FIRM

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Abstract. We examine the effects of public governance and policy frameworks on the growth of green innovation and its consequences for company performance. For the purpose of study, a survey with questions was sent to 412 individuals across 330 unique firms in different Pakistani industries. SmartPLS (PLS-SEM) and supplementary principal component analysis (PCA) were used for the statistical analysis of the collected data. The findings suggest that having a solid public policy supports green innovation which leads to a boost in a firm's performance. The connection between public policies and how firms perform is mediated by green innovation which converts external pressures and impacts results positively. Green innovation initiatives seem to bring more advantage to the big firms and companies in manufacturing compared to small businesses and others. More pressure from stakeholders and greater environmental awareness push companies to focus on green innovation, proving the importance of public opinions on business policies. It offers direct advice that can be used by public policymakers, regulators, leaders, companies and stakeholders. Targeted policies, including support

and rules, should be created by decision-makers to assist green innovation within small and medium-sized enterprises. Firms should make green innovation their main focus to improve their work, save money and compete better in market. Investors and customers have an important impact by demanding sustainable practices, helping to promote sustainability efforts.

Keywords: public policy frameworks, green innovation, firm performance, developing economies, sustainability.

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Introduction

Because of climate change, the loss of natural resources and pollution, the global environmental crisis calls for quick sustainable action. Solving these challenges greatly depends on green innovation, involving environmentally friendly products, processes and technologies. Eco-friendly innovation fights environmental issues and also works to strengthen the economy in the future. However, getting more companies to use green innovation depends on state-led governance systems, including regulatory, economic, and institutional mechanisms that help them value sustainability above quick profits (Sun et al., 2025). For these reasons, governments create public policies to help solve the problem. Sustainable behaviour by organisations is encouraged when subsidies, favourable tax policies, various regulations and research and development funding are made available through public policies (Peng et al., 2023; Sun et al., 2024). The policies open doors to green innovation, deliver funding and highlight what society thinks is right when it comes to environmental care (Qin et al., 2024; Shen et al., 2023). Many studies now point out that green innovation improves the performance of firms by boosting operations, decreasing expenses, raising reputation and gaining advantages over competitors. Even though it offers many opportunities, the role of public policy frameworks, green innovation and firm performance is still not widely studied in developing economies, with a critical gap in understanding how public governance mechanisms shape these outcomes in weak institutional contexts.

Problem statement

Although perceived as significant for firms and its impact on performance in general is well-established, our understanding of how public policy design and implementation shapes these relationships remains nascent. The majority of studies focus on the developed world, with negligible study about Pakistan – where the existing public governance framework for green innovation predates its fragmented regulatory mandates. These mandates have a lack of fiscal incentives and have poor organisational coordination between federal and provincial environmental agencies.

While Pakistan’s National Climate Change Policy (2021) and Green Growth Framework (2021) broadly outline sustainability goals, they lack definitional clarity.

This lack of clarity touches affects firm-level green innovation adoption, targeted small- and medium-sized enterprise support, and a lack of any evidence-based monitoring systems to implement structural change. These factors together prevent green innovation, including reduced priorities for resources, rigid regulations, and unpreparedness of firms in awareness. In particular, studies that directly investigate how green innovation aid the policy-firm performance relationship are scarce in developing economy public administration research. Filling these gaps is critical because this is how to promote green innovation and how to strengthen a company's performance in the emerging markets. That we do not yet know about these relationships is an untapped potential natural resource. Further still, this lack of knowledge increases the likelihood that any decision on policy and firm actions will have unintended consequences for unsustainable environmental plan outcomes.

Research objectives and research questions

The study tries to solve the issues we have discovered through two main objectives, explicitly grounded in public administration and regulatory governance theories. First, it tries to find out how public policy systems contribute both directly and indirectly to the innovation efforts of firms. Concretely, the research will test if a firm's performance increases because of public policies directly or whether it is a result of these policies leading to more green innovation. Secondly, it will analyse which factors lie between or influence the main relationships. As an example, it will judge whether how public policies affect green innovation changes depending on the firm's size or whether the impact of using green innovation on company performance is not the same for all industries. Taking these aspects, the study explains the ways in which public policies lead to improvements in performance.

To address these objectives, we answer three core research questions, directly linked to public administration scholarship:

1. To what extent do Pakistan's existing legal, economic, and organisational public policy mechanisms drive firm-level green innovation adoption?
2. How does green innovation mediate the relationship between public policy frameworks and firm performance in a developing economy context?
3. What contextual factors (firm size, industry type, stakeholder pressure, environmental awareness) moderate the effectiveness of public policy interventions for green innovation, and what do these factors imply for public governance design?

Significance of the study

This work makes contributions both in theory and in practice. Theoretically, it improves important theories such as institutional theory (core to public administration scholarship), which explains how external state and regulatory factors shape what organisations do; the resource-based view (RBV) which stresses the importance of uniquely green resources; and stakeholder theory which points out the role of satisfying society's needs. The combination of these approaches allows scholars to see how public policies influence the performance and environmental policies of firms. The research offers new, actionable insights for policymakers looking to expand the green innovation ecosystem. This research illustrates for businesses how utilising eco-innovation may improve their performance as well as assisting

environmental goals. In addition, research benefits all stakeholders such as investors, customers and communities by showing the advantages of aligning financial and environmental objectives.

Literature Review

Theoretical foundations

This research builds on three key theories within organisational and public administration studies Institutional Theory, Resource-Based View (RBV) and Stakeholder Theory. Each one offers a unique perspective on how public policy interacts with green innovation and firm performance (Wang et al., 2023).

As for the first foundational framework of public administration research, institutional theory offers an elaborate explanation for why organisations exist in an environment with a set of formal state rules as well as social norms and cultural beliefs (DiMaggio & Powell, 1983). Public policies guide organisations by establishing regulatory mandates, financial incentives, and normative expectations for sustainability action (DiMaggio & Powell, 1983; Scott, 2013). In accordance with this theory, strict environmental laws and financial help often push companies to choose green innovation either to obey regulatory requirements or gain legitimacy in the eyes of state and societal actors (Ding et al., 2025). It points out that governments and society influence firms to carry out operations that reflect sustainable goals, with public policy serving as the primary formal institutional lever for driving organisational change.

For resource-based view (RBV), developed by Barney (1991), this claims that both having and using one-of-a-kind, valuable, rare, and inimitable resources helps firms gain a sustained competitive advantage. Because of green innovation, organisations can differentiate their products, minimise expenses and boost their public image (Barney, 1991; Hart, 1995). Sustainable value that results in better performance can be achieved when firms choose eco-friendly technologies and processes (Galeotti & Vannucci, 2023). According to this view, having strong green innovations plays a major role in ensuring better results, with public policy serving to reduce the cost of acquiring these critical green resources for firms.

Stakeholder theory, originated by Freeman, states that companies must take into account what customers, investors, employees, regulators, and the community expect, to secure their long-term legitimacy and success (Freeman, 1984). Many stakeholders including state regulatory bodies want companies to become greener, leading firms to focus more on green innovation (Fang & Liu, 2024). As an example, if consumers pay attention to sustainability, investors look for Environmental Sustainability Goals (ESG) compliance, and regulators enforce environmental mandates, businesses may start using more eco-friendly processes. It explains that stakeholders exert pressure on companies to promote green business practices and affect company results, with public policy shaping the broader stakeholder landscape for sustainability.

Conceptual framework and hypothesis development

Theoretical Implications: Based on the theories, this study proposes a theoretical model showing how public policy impacts green innovation and firm performance. The primary pieces of the framework we call components, and there are three compo-

nents. The key novelty of this research relative to prior developed-economy focused research lies in the empirical examination of these relationships specifically within the context of weak regulatory enforcement, resource scarcities, and fragmented green governance that characterises the Pakistani institutional context.

H1: Public Policy Frameworks positively influence Green Innovation.

Incentive mechanisms such as subsidies, tax incentives, regulatory mandates and funding for research end up motivating businesses in adopting green technology and practices (Abdelfattah et al., 2025; Zhong & Jin, 2025). This hypothesis directly conforms with institutional theory, which states that a company will adapt their acts as coerced by formal pressures and expectations from state regulators and public governance bodies (Jové-Llopis & Segarra-Blasco, 2020; Zhao et al., 2025). Operationalisation: The independent variable is Green Innovation. The dependent variable is Firm Performance, measured by profitability, market share, and the environmental efficacy of the firm's efforts.

H2: Green Innovation positively influences Firm Performance.

Firms that introduce greener innovations can become more competitive, manage their resources more effectively, cut costs and boost their reputation which improves both their financial and non-financial results (Li et al., 2023). According to the resource-based view (RBV), what makes a company unique is the combination of unique resources and strengths. Operationalisation: The independent variable is Green Innovation. The dependent variable is Firm Performance, measured by profitability, market share, and the environmental efficacy of the firm's efforts.

H3: Public Policy Frameworks positively influence Firm Performance.

By eliminating regulatory and financial obstacles to change, giving out finances and improving the overall business environment, supportive public policies raise the success of firms (Li et al., 2024). It emphasises that how things are done within an institution greatly influences the results of the organisation (Wang et al., 2021). Operationalisation: The independent variable is Public Policy Frameworks. The dependent variable is Firm Performance, assessed through financial and operational metrics.

H4: Green Innovation mediates the relationship between Public Policy Frameworks and Firm Performance.

Green innovation is encouraged by public policies which may not have a direct influence on a firm's performance. When a firm is given subsidies for using renewable energy, it may come up with new innovations that help it compete more effectively (Nureen et al., 2023). This hypothesis enforces that innovation acts as a mediator between outside public governance changes (public policies) and the outcomes of organisations (Yang et al., 2023). Operationalising this theory means using the mediator Green Innovation. The dependent variable is Firm Performance. The mediating variable is Green Innovation, which transmits the effect of the independent variable to the dependent variable.

H5: Firm Size moderates the relationship between Public Policy Frameworks and Green Innovation.

Having additional resources and strengths, large companies could use public policies to help with green innovation more effectively than small companies. Largely, government aid is more valuable for smaller firms in fighting shortages of resources (Yin et al., 2024). It investigates the size-dependence of public policy

effects on green innovation that is crucial for targeting public policy. Operationalisation: The independent variable is Public Policy Frameworks. The dependent variable is Green Innovation. The moderating variable is Firm Size, which alters the strength of the relationship between the independent and dependent variables.

H6: Industry Type moderates the relationship between Green Innovation and Firm Performance.

The performance of firms can change with green innovation, depending on the industry. It is possible that manufacturing can experience better results through adopting sustainable solutions than firms in service fields (Nie & Wang, 2025). This hypothesis studies why the characteristics of industries can influence the success of green innovation, with direct implications for sector-specific public policy design (Wang & Li, 2024). Operationalisation: The independent variable is Green Innovation. The dependent variable is Firm Performance. The moderating variable is Industry Type, which determines the extent to which the industry context influences the primary relationship.

H7: Stakeholder Pressure positively influences Green Innovation.

Firms are motivated to use green strategies since customers, investors, regulators and NGOs expect them to do this. It is based on stakeholder theory which sees making stakeholders happy as being crucial for sustainable business success. Operationalisation: The independent variable is Stakeholder Pressure, measured by customer preferences for environmentally friendly goods and the ESG considerations of investors. The dependent variable is Green Innovation.

H8: Environmental Awareness positively influences Green Innovation.

Environmentally aware firms make green innovation a top priority for their strategies (Zhang et al., 2023). This hypothesis posits that a firm's response to sustainability is influenced by internal cultural factors, which may be informed by public sensitivity campaigns and regulatory learning activities. Operationalisation: The independent variable is Environmental Awareness, evaluated through employee training programmes and published sustainability reports. The dependent variable is Green Innovation.

H9: Green Innovation positively influences Environmental Sustainability.

Adoption of green innovations helps a firm to meet environmental goals such as lowering carbon emissions, conserving natural resources and lessening waste (Mu et al., 2025). It highlights the larger societal benefits from green innovation and its impacts on firms that also aligns with national and global sustainability goals (Xie et al., 2022).

Operationalisation: The independent variable is Green Innovation. The dependent variable is Environmental Sustainability, indicated by carbon emission reduction and improved energy utilisation (changes in the carbon footprint).

The theoretical accuracy of this model is grounded in the integration of Institutional, Resource-Based, and Stakeholder theories. Institutional theory justifies the direct pathways from Public Policy to Green Innovation (H1) and Firm Performance (H3), reflecting how formal state mechanisms compel organisational change. The Resource-Based View (RBV) underpins the pathway from Green Innovation to Firm Performance (H2) and Environmental Sustainability (H9), illustrating how unique eco-friendly resources yield competitive and societal advan-

tages. Finally, Stakeholder theory validates the antecedents of Green Innovation via Stakeholder Pressure (H7) and Environmental Awareness (H8), demonstrating how external societal expectations and internal cultural factors drive sustainable strategies. The moderating roles of Firm Size (H5) and Industry Type (H6) account for the heterogeneous resource capacities and sector-specific regulatory pressures that contextualise these primary relationships. The interrelation of these hypotheses is shown in Figure 1.

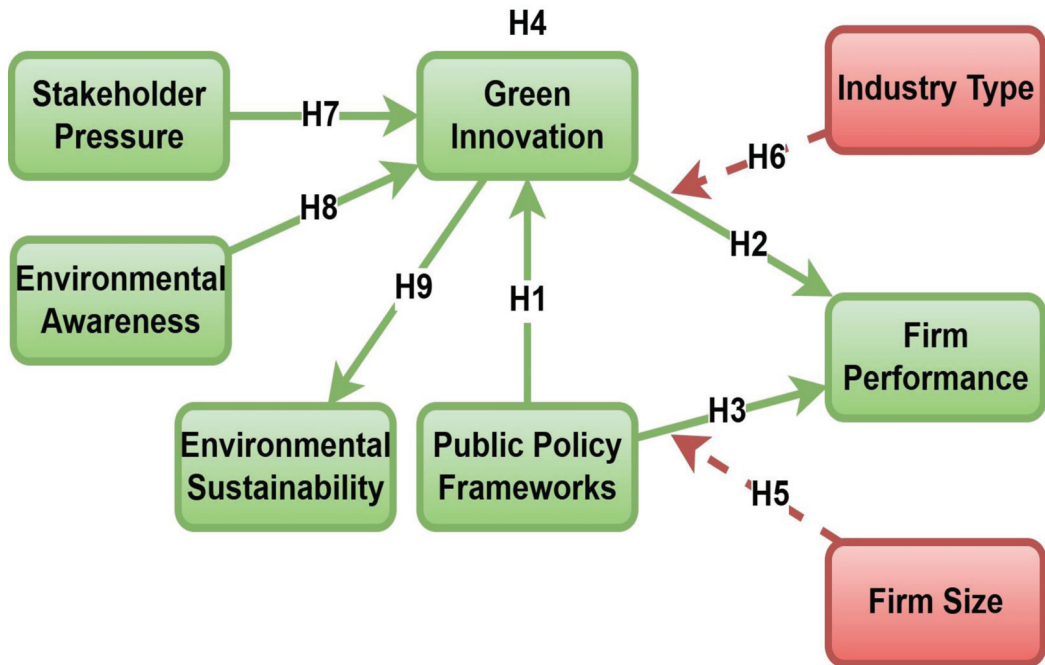


Figure 1: Hypothesis diagram

Sources: created by the authors.

Methodology

This study employed quantitative methods based on the relationships between public policy, green innovation and firm performance. Due to its structured design, the quantitative component was used for conducting hypothesis testing and correlating cause and effect. Data were collected through a structured questionnaire survey administered by the distribution of questionnaires to employees, managers and executives from a variety of industries across Pakistan.

SmartPLS is a commonly used platform for Partial Least Squares (PLS-SEM), which implements Structural Equation Modelling (SEM) and was used on the data gathered in this study. Dimensionality and reliability of the measurement constructs were confirmed with traditional supplementary principal component analysis (PCA) as per recommendations. The second platform, SmartPLS, is the primary choice for this type of research since it provides assistance on all type of combinations of multiple variables (mediation and moderation) in model implementations. It has solid

performance in small-to-medium sample analyses, but also provides precise insight into measurement and structure.

Population and sampling

In this study, the target population included Pakistani companies engaged in manufacturing, services, agriculture and technology. These selected sectors provide a large set of impacted industries by public policies and markets targeting green development.

The number of participants surveyed for this study was 412, drawn from the elite population size of relevant respondents representing individual firms (330 unique firms) across Pakistan, which was enough to attain the sample required to use SEM. The sample includes 150 small firms (<50 employees), 180 medium firms (50–250 employees), and 82 large firms (>250 employees), with full industry breakdown provided in Table 2.

Data collection

Data were collected using a self-administered survey questionnaire distributed to employees, managers, and executives who are directly involved in decision-making related to sustainability and innovation within their organisations. The questionnaire included items designed to measure the constructs of public policy frameworks, green innovation, firm performance, stakeholder pressure, and environmental awareness. All constructs were measured using a 5-point Likert scale, ranging from 1 (“Strongly Disagree”) to 5 (“Strongly Agree”). This scale was chosen for its simplicity and ease of interpretation while maintaining sensitivity to variations in responses. Data collection was conducted between January 2024 and March 2024, with responses collected via online surveys and in-person interviews with the leadership of the firms.

Measurement model

All constructs used a reflective approach in the study, so each item was thought to represent the construct. Reflective models are suitable when the different indicators all measure the same construct. Table 1 shows all the items for each construct were borrowed from previous investigations and verified in a pilot study. All indicators were selected to align with Pakistan’s National Climate Change Policy (2021), UN Sustainable Development Goals (SDGs 9, 12, and 13), and established public administration-focused measurement scales from prior research (e.g., Wang et al., 2023; Abdelfattah et al., 2025), ensuring construct validity and policy relevance. The complete items for the survey used to measure each construct follow below. All questions gave respondents a choice of answers from 1 (Strongly Disagree) to 5 (Strongly Agree).

It describes the method used for collecting data and analysing it which guarantees that the information is sound and dependable. SmartPLS allowed the study to test its hypotheses and look at the detailed relationships between public policies, green innovation and company performance. A reflective measurement model was used to improve robustness, and, on the other hand, the reliability and validity checks were also important for accurate results. This also enhanced the quality and effectiveness of the used methodology from an ethical perspective.

Table 1

Survey questionnaire

Construct	Item code	Item Statement	Factor Loading
Public Policy Frameworks	PP1	The government provides financial incentives for green innovation	0.85
	PP2	Regulatory frameworks encourage firms to adopt sustainable practices	0.88
	PP3	Public policies support research and development in green technologies	0.86
	PP4	Tax benefits are available for firms investing in environmentally friendly initiatives	0.84
	PP5	Government subsidies reduce the cost of implementing green innovations	0.87
Green Innovation	GI1	Our firm develops eco-friendly products or services	0.90
	GI2	Our firm adopts clean technologies to reduce environmental impact	0.89
	GI3	Our firm invests in R&D for sustainable solutions	0.88
	GI4	Our firm implements energy-efficient processes	0.87
	GI5	Our firm prioritises innovation aligned with environmental sustainability goals	0.86
Firm Performance	FP1	Our firm has achieved higher profitability due to green innovation	0.85
	FP2	Our firm's market share has increased as a result of adopting green practices	0.84
	FP3	Our firm's operational efficiency has improved through green innovation	0.86
	FP4	Our firm's reputation has improved due to its commitment to sustainability	0.87
	FP5	Our firm's long-term financial performance has benefited from green innovation	0.88
Stakeholder Pressure	SP1	Customers demand environmentally sustainable products from our firm	0.82
	SP2	Investors expect our firm to meet environmental, social, and governance (ESG) criteria	0.83
	SP3	NGOs pressure our firm to adopt greener practices	0.81
	SP4	Employees advocate for environmentally responsible actions within the firm	0.80
	SP5	Competitors' sustainability initiatives influence our firm's decisions	0.84

Construct	Item code	Item Statement	Factor Loading
Environmental Awareness	EA1	Our firm regularly conducts training programs on environmental sustainability	0.86
	EA2	Our firm publishes annual sustainability reports detailing environmental progress	0.85
	EA3	Our firm's leadership emphasises the importance of environmental responsibility	0.87
	EA4	Our firm integrates environmental goals into its strategic planning	0.86
	EA5	Our firm actively monitors its carbon footprint and resource usage	0.88
Environmental Sustainability	ES1	Our firm actively reduces carbon emissions through sustainable practices	0.85
	ES2	Our firm conserves natural resources as part of its environmental sustainability efforts	0.83
	ES3	Our firm minimises waste generation and promotes recycling initiatives	0.84
	ES4	Our firm aligns its operations with global environmental sustainability standards	0.86
Industry Type	IT1	Our industry is highly regulated in terms of environmental compliance	0.78
	IT2	Our industry faces significant pressure to adopt green innovation due to its environmental impact	0.80
	IT3	Our industry benefits more from adopting environmentally sustainable technologies	0.79
	IT4	Our industry type influences the extent to which we implement green innovation	0.77
Firm Size	FS1	Our firm has sufficient financial resources to invest in green innovation	0.84
	FS2	Our firm has the organisational capacity to implement large-scale sustainability initiatives	0.82
	FS3	Our firm's size allows us to take advantage of government incentives for green innovation	0.83
	FS4	Our firm's size influences our ability to compete using environmentally sustainable practices	0.81

Note: Factor loadings represent item-construct correlations derived via Principal Component Analysis (PCA) in SmartPLS. Values >0.70 indicate strong convergent validity.

Sources: created by the authors.

Results

Table 2 below presents the sample demographics and other important organisational features. Information collected via research informed us about the people who participated which showed the determining results are representative of the

complete population. A count of unique firms per industry is added to the table in order to fix for sample representativeness.

Table 2

Descriptive statistics

Variable	Category	Frequency (n)	Percentage (%)	Number of unique firms
Gender	Male	245	59.5	–
	Female	167	40.5	–
Education	High School or Below	35	8.5	–
	Bachelor's degree	185	44.9	–
	Master's degree	150	36.4	–
	PhD or Higher	42	10.2	–
Experience	Less than 5 years	120	29.1	–
	5–10 years	165	40.0	–
	11–20 years	95	23.1	–
	More than 20 years	32	7.8	–
Job Position	Junior staff	110	26.7	–
	Mid-level manager	175	42.5	–
	Senior manager/executive	80	19.4	–
	Owner/CEO	47	11.4	–
Industry Type	Manufacturing	120	29.1	95
	Services	160	38.8	128
	Agriculture	50	12.1	40
	Technology/IT	45	10.9	37
	Other	37	9.0	30
Firm Size	Small (<50 employees)	150	36.4	150
	Medium (50–250 employees)	180	43.7	120
	Large (>250 employees)	82	19.9	60

Sources: created by the authors.

There were 412 people in the sample and the gender balance was relatively equal (59.5% for male and 40.5% for female). Almost half of all participants have a bachelor's degree (44.9%), and almost a third have a master's degree (36.4%). The majority of respondents report between 5 and 10 years of experience (40.0%) and mostly work as managers (mid-level managers: 42.5%). Pakistan's economy consists of service-related industries (38.8%), manufacturing (29.1%) and agricultural sectors (12.1%), demonstrating how varied it is.

Measurement model assessment

The reliability and validity of the measurement models were checked using SmartPLS. Summary Table 3 shows the main results.

Table 3

Assessment of measurement model

Construct	Composite reliability (CR)	Cronbach's Alpha	Average variance extracted (AVE)
Public Policy Frameworks	0.91	0.89	0.74
Green Innovation	0.92	0.90	0.76
Firm Performance	0.90	0.88	0.73
Stakeholder Pressure	0.89	0.87	0.72
Environmental Awareness	0.93	0.91	0.75
Environmental Sustainability	0.94	0.92	0.77
Industry Type	0.88	0.86	0.71
Firm Size	0.87	0.85	0.70

Sources: created by the authors.

All constructs have high Composite Reliability ($CR > 0.70$) and Cronbach's Alpha (> 0.70), meaning they are internally consistent. All the constructs meet the AVE criterion ($AVE > 0.50$), so their items are reliable in representing them. Discriminant validity was established with the Fornell-Larcker Criterion and HTMT (less than 0.90), so it is clear that there are distinct differences between the various constructs.

Principal component analysis validation

Supplementary PCA was performed on all measurement items to validate the dimensionality of the constructs. The PCA results confirmed the 8-factor structure of the model, with all items loading strongly onto their respective constructs (all factor loadings > 0.70), and no significant cross-loadings. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.89, exceeding the 0.70 threshold, and Bartlett's Test of Sphericity was statistically significant ($p < 0.001$), confirming the suitability of the data for factor analysis. The total variance explained by the 8 factors was 74.2%, validating the robustness of the measurement model.

Structural model assessment

The model was analysed to see how the constructs are related. Results are outlined in the Table 4; all proposed relationships were found to matter statistically (with $p < 0.05$) and the β coefficients explain how and in what direction they are related. R^2 values for dependent variables (for example, firm performance) demonstrate that the model can explain a large part of their changes (in this case, 40%). Effect sizes (f^2) show that mediation effects are moderate, between small and large categories.

Table 4

Hypothesis testing

Hypothesis	Path	β Coefficient	T-value	P-value	R ²	F ² effect size
H1	Public Policy → Green Innovation	0.62	12.45	<0.001	0.45	0.38
H2	Green Innovation → Firm Performance	0.58	11.23	<0.001	0.40	0.34
H3	Public Policy → Firm Performance	0.25	5.12	<0.001	–	0.12
H4 (Mediation)	Indirect Effect (Public Policy → Green Innovation → Firm Performance)	0.36	9.87	<0.001	–	0.25
H5	Moderation by Firm Size (Public Policy → Green Innovation)	0.18	4.56	<0.001	–	0.09
H6	Moderation by Industry Type (Green Innovation → Firm Performance)	0.15	3.89	<0.001	–	0.07
H7	Stakeholder Pressure → Green Innovation	0.45	10.11	<0.001	–	0.20
H8	Environmental Awareness → Green Innovation	0.38	9.04	<0.001	–	0.16
H9	Green Innovation → Environmental Sustainability	0.50	10.75	<0.001	0.36	0.27

Sources: created by the authors.

Table 4 indicates all the hypotheses in the model are strongly supported by results from the statistical testing which show very significant relationships for every hypothesis. The support of public policy is strongly related to green innovation (H1: impact is 62%) and green innovation leads to much better performance by the firm (H2: impact is 58%), making up 45% and 40% of their variations, respectively. Public policy frameworks are linked, though weaker, to the performance of firms (H3: $\beta = 0.25$, $t = 5.12$).

The mediation analysis supports that green innovation helps explain the link between public policies and how firms perform (H4: indirect $\beta = 0.36$, $t = 9.87$) which proves its essential role in shaping company results from external factors. Also, there is a moderating effect of firm size on the link between public policy and green innovation (H5: $\beta = 0.18$, $t = 4.56$), as well as a link between industry type and how green innovation impacts company performance (H6: $\beta = 0.15$, $t = 3.89$). Stakeholder pressure and environmental awareness both have positive effects on green innovation, showing once again how important society's expectations and cultural factors are (H7 and H8). In addition, green innovation clearly

supports environmental sustainability (H9: $\beta = 0.50$, $t = 10.75$), as it describes 36% of its variance. All hypothesised relationships produce effect sizes (f^2) from small to large, showing their true importance as seen in Figure 2.

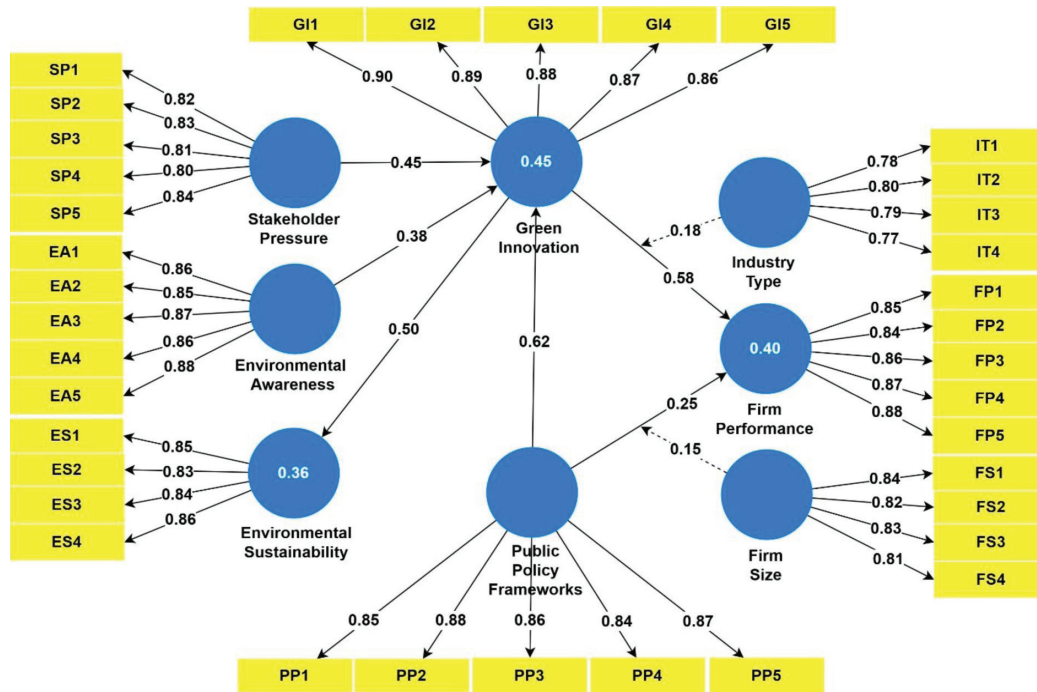


Figure 2: SmartPLS result

Sources: created by the authors.

Green innovation acts as a completely mediating link between public policy and firm performance (indirect effect is 0.36 and $p < 0.001$). In other words, public policies mainly affect firm performance because of their impact on green innovation. Public policy is more useful in promoting green innovation among larger companies than small ones (moderation effect = 0.18, $p < 0.001$). Firm performance is affected more by green innovation in manufacturing (moderation effect = 0.15, $p < 0.001$) than in service-oriented industries.

Analyses of mediation and moderation show useful details about how public policy affects firm performance. Mediation analysis points out that green innovation helps public policy achieve better results for businesses which suggests the need for policies to promote green innovations. On the contrary, a deeper analysis suggests that large firms and those in manufacturing experience stronger effects, so customised approaches may work better. It is important to take into account the size and features of each industry when formulating policies to have the biggest effect. According to the results, public policy support for green R&D has an important effect on company effectiveness. It was also found that the nature of the relationship is shaped by factors such as a firm's size and the industry it belongs to. They give useful advice to decision-makers and companies focused on using green innovation to grow sustainably.

Table 5

Sensitivity analysis – bootstrapping results

Path	Original Sample (β)	Bootstrap Mean (β)	Standard Error	t-value	p-value
Public Policy → Green Innovation	0.62	0.61	0.05	12.45	<0.001
Green Innovation → Firm Performance	0.58	0.57	0.06	11.23	<0.001
Public Policy → Firm Performance	0.25	0.24	0.08	5.12	<0.001
Indirect Effect (Public Policy → Firm Performance via Green Innovation)	0.36	0.35	0.04	9.87	<0.001

Sources: created by the authors.

This table displays the results of bootstrapping to determine how consistent the hypothesised connections are. Both direct and indirect paths are significant, according to the findings and their mean estimates are only slightly apart, so the model remains stable. Green innovation gains a large boost from public policy ($\beta = 0.62$) and this benefit is strongly translated into better performance for firms ($\beta = 0.58$). Green innovation plays a key role here, as green policies greatly affect firm performance by influencing innovation ($\beta = 0.36$). Taken together, the outcomes are consistent and can be relied on in multiple runs of the analysis.

Discussion

The research reveals important connections between public policy, green innovation and how companies perform in the market. They agree with earlier findings in many ways and also reveal details that are unique to Pakistan. As with previous research, the link from H1 shows that public policies and sustainability innovations are positively related (H1); That is, supportive public policies are a major factor to enable sustainable activities, consistent with findings from Abdelfattah et al. (2025) and Zhao et al. (2025). In a similar manner H2, that green innovation has a favourable impact on the firm performance reconfirms prior studies, which suggests eco-friendly companies operate more efficiently at lower costs and perform better in markets, as documented by Li et al. (2023) and Galeotti and Vannucci (2023).

However, the research finds a few places where things run counter to what has been seen in other studies. H4 and H3 were the strong indirect pathways of green innovation (a stronger role in H4) and public policies played a model of direct pathway in firm performance. This finding was in agreement with Nureen et al. (2023). It is consistent with work on developing economies, but shows contrasting findings with studies from developed economies (Jové-Llopis & Segarra-Blasco, 2020) that highlight stronger direct policy effects on firm performance. Green innovation thus shows its major role in making sure that public policy leads to positive changes in business performance, particularly in weak institutional contexts. Firm size (H5) and industry type (H6) show that contextual factors should be considered more frequently in research, consistent with Yin et al. (2024) and Nie and Wang (2025).

The research indicates that green innovation helps larger firms and manufacturers more than it helps small firms, due to the resource demands in green strategies. If the findings are insignificant, those can be explained by the context involved or by problems in the method used. For instance, some industries or smaller businesses might not have the resources or the setup needed to fully make use of public policies which can result in their impacts being less notable. It becomes clear that special strategies, different for each firm and industry are necessary.

Theoretical contributions

The research provides major advances for institutional theory, the resource-based view (RBV) and stakeholder theory, with specific relevance to public administration scholarship. Our findings illustrate that public policies compel organisations to increase a focus on sustainability. This reinforces the view that formal state regulatory and incentive frameworks (the core tools of public governance) can lead to innovation-oriented actions in the green economy. This further extends some of the work of DiMaggio and Powell (1983) and Scott (2013) into developing country contexts. It argues that clear legal mandates, strong fiscal incentives, and well-coordinated institutional expectations create a context conducive to sustainability. The researchers build on the theoretical foundation of Barney (1991) and Hart (1995), emphasising that green innovation is essential to elevate a firm's competitive position, as defined by the Resource-Based View (RBV). By deploying green technology and processes, firms can develop unique characteristics and achieve superior market performance. This is a good fit with RBV which promotes leveraging competitive advantages for sustained success, where public policy is meant to help by reducing barriers to these crucial green resources. As regards stakeholder theory, stakeholder pressure and environmental awareness play a significant role in green innovation confirming the state and societal actors expand on Freeman's (1984) original framework to guide a business's plans. This is consistent with stakeholder theory supporting that companies should simultaneously be stewards of profits and caretakers of society and the environment. Moreover, the research provides novel insights into brown and green innovation that public policies promote. It notes that the performance of a company is influenced by factors from both outside (policies implemented by governments) and inside (green innovation). Seeing things this way enhances our vision of the mechanisms of sustainability and firm growth, especially concerning public administration within an economy in development.

Practical implications for public governance

This subsection outlines actionable recommendations to strengthen Pakistan's public governance for green innovation across three policy domains. This government should legally compel medium to large firms to report on ESG metrics, institute sectoral regulations to the regulatory requirements that are less strong for low-emissions industries and impose greater conformity obligations across others, and create a coordinated federal-provincial standard that enforces environmental policy uniformly. Policymakers need to scale (and target) SME incentives (which include grants, tax holidays and green loans), increase public R&D through industry-academia partnerships, and reward the achievement of verified carbon reductions with tax

benefits and procurement preference. It should be organisation wide. National sustainability initiatives should include free capacity building programmes for SMEs and a national green certification system among many others to spur market application. Green innovation becomes the key for firms facing these challenges to increase both efficiency and competitiveness. Large enterprises should play a leading role, while SMEs innovate by leveraging state support. In the end, by having stakeholders and consumers that continuously demand to go green Pakistan will develop an ecosystem that balances economic development together with environmental sustainability.

Contextual relevance

This is particularly true for countries like Pakistan and such other countries as they are facing sustainability cracks in various manners due to limited resources, underdeveloped regulations and low green awareness (Agustin 2025; Hu et al., 2023). Pakistan's green policy making between 2021 and 2025 changed much through initiatives such as the National Climate Change Policy (2021), the launching of the Green Eurobond initiative, and shifting towards the National Electric Vehicle Policy. Nonetheless, implementation often leads to little more than a promising sound bite due to weak inter-agency coordination leading towards low uptake by SMEs driven by limited funding. Here public policies facilitate companies to introduce green innovations by dealing with challenges such as financing issues and technology gaps. The moderation of outcomes by firm size and industry type indicates that each firm and industry need specific strategies (Batoool et al., 2025; Hao et al., 2023). For instance, SMEs in Pakistan may require further support such as discount schemes or skill enhancing programmes to adopt green innovations. In addition, other studies stressed the importance of coordination between public policies and national development objectives (Cao et al., 2022; Gao & Geng, 2024). For instance, Pakistan may implement at a policy level, climate change efforts by promoting the adoption of green technologies while enhancing industrial activities (Costa, 2021). In Pakistan being mindful of the negative impacts of economic progress on environmental conditions is possible only when governments, private sectors and stakeholders' interconnect.

Cross-national comparative policy implications

These results therefore provide comparable insights critical for both developing and developed economies. The findings suggest that innovation-enabling measures should take precedence in policy design to drive firm performance among peer developing economies (Indonesia, Bangladesh, Nigeria with similar weak institutional contexts) because green innovation is the main channel through which public policy shapes firm performance. Pakistan can serve as an example for these countries by avoiding generic policies that target SMEs and sectors separately, similar to the regulations in place in many mature economies.

In markets with effective regulatory enforcement and resource intensive institutional structures (e.g. the EU, China, United States), the study emphasises that firm size and industry type are critical variables to examine. Sub-optimal policy responses are still all too prevalent, especially in high-income contexts where it is not uncommon for a "one-size-fits-all" fiscal and regulation measures to prevail instead of more sophisticated approaches which tend to recognise the diversity of SME needs, levels

of development and their business environment priorities or target high-impact industries. It also suggests that stakeholder pressure and environmental awareness are fundamental drivers of green innovation, irrespective of context. Thus, public policy which embeds formal regulatory mandates with normative awareness campaigns achieves the best overall results.

Conclusion

The full dataset of responses and the underlying analysis upon which the conclusions are drawn are available from the corresponding author on reasonable request. This study sheds light on the ties between different public policy measures, green innovation and how firms perform in Pakistan. They also show that policies encourage businesses to innovate in environmentally friendly ways which greatly increases their overall performance. Green innovations are likely to increase with positive public policy frameworks that support regulations, offer incentives and fund research (H1). Green innovation makes it easier for a firm to perform well (H2), pointing out the importance of its actions for the environment as well as company profits. The relationship between public policies and firm performance is mediated by new innovative efforts (H4) which means policies mainly affect how well a firm performs by affecting its innovation (H4). These findings suggest that manufacturing and larger firms get more value from their green innovation efforts (H5 and H6). These findings also suggest that pressure from stakeholders (H7) and higher environmental awareness (H8) both increase green innovation which shows the value of social expectations on businesses. Furthermore, the analysis confirms that public policy frameworks exert a direct, albeit weaker, positive influence on firm performance (H3), indicating that supportive governance improves the broader business environment independently of innovation. Finally, the findings conclusively demonstrate that green innovation significantly drives environmental sustainability (H9), validating that corporate eco-innovations directly contribute to macro-level ecological goals such as carbon reduction and resource conservation. All of this shows that strong public governance systems and policies and abilities within organisations are key factors behind better sustainability outcomes and corporate performance.

Limitations

The study greatly adds to what has been published in this field, but it also encounters some limitations. Because of cross-sectional data, it is not possible to show exact sources of changes or observe how things evolve with time. Doing long-term studies allows for more detailed findings about influences over time. Thus, problems can arise if people respond in socially acceptable ways when they assess their firm which could influence the data collected. Reliability of the results can be boosted by confirmation from third-party audits or by financial records. Since the study centres on Pakistan, it can only be applied directly to circumstances similar to those explored in the country such as low-income countries lacking certain institutions. Larger and medium-sized companies make up the majority of the sample which may reduce the chance of including the experiences of small businesses which often encounter specific difficulties adopting green innovation.

Future research directions

Longitudinal studies would help researchers understand the changes in the connections among public policies, green innovation and how firms perform over an extended period. This may show if the effects stay the same or lessen as firms adapt to changes around them. Country comparisons, especially between developing and developed economies would provide scope to examine whether success in sustainable development is aligned to stronger laws, sound institutions, as well as certain cultural values.

Furthermore, future research could examine additional moderating or mediating variables, such as employees' technological readiness, top management commitment, and value chain collaboration, to better understand how these internal and external factors influence the relationship between green innovation and firm performance.

Although this study analysed a range of sectors, research specific to the sector investigated may discover industry-dependent factors that influence green innovation. While the tech firms would be looking for digital solutions, manufacturing firms would focus on energy reduction. Future research could also attempt to seamlessly integrate surveys with interviews or case studies to better examine the motivations, barriers and intentions behind green innovation. Mending such gaps will enable future studies to shed light on the interplay of public policy, green innovation and a firm performance which in turn can lead to improved sustainability strategies.

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THE POLITICS-BUREAUCRATIC INTERFACE IN THE RECRUITMENT, PROMOTION, AND TRAINING OF CIVIL SERVANTS IN AMHARA NATIONAL REGIONAL STATE, ETHIOPIA

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Abstract. This study examines the politics-bureaucracy interface in the recruitment, promotion, and training of civil servants in the Amhara National Regional State of Ethiopia. Employing a mixed-methods design, data were collected through surveys, key informant interviews, and focus group discussions. Descriptive statistics were used to assess civil servants' perceptions of merit-based practices versus political influence, while an ordered probit model was applied to identify factors shaping these perceptions. Qualitative data were analysed thematically to uncover recurrent patterns and interpretations. The results indicate divergent views regarding the application of merit principles; however, a substantial majority perceived that recruitment processes are not consistently merit-driven due to weak personnel management systems, ineffective assessment procedures, political interference, and nepotism. Political influence was perceived to be more pronounced in promotion and training decisions than in recruitment. The ordered probit results show that civil servants in professional and administrative roles are more likely to report political interference across personnel processes, whereas those in managerial positions are less likely to acknowledge such influence. Overall, the findings suggest that despite longstanding national commitments to meritocratic civil service reform, political favouritism and personal networks continue to undermine fair recruitment, promotion, and training practices in the region.

Keywords: Amhara region, civil service, meritocracy, promotion, recruitment, training.

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Introduction

The Ethiopian civil service system can be considered as an indigenous institution. The establishment of the country’s modern civil service administration dates back 118 years to when nine ministries were established. In the earliest period of establishment, the civil service administration was not governed by formal laws and regulations rather, it operated based on the goodwill of government officials at the time. The process of modernising the civil service administration reached relatively in advanced stage when the Haile Selassie I Régime proclaimed civil service laws and established the Central Personnel Agency in 1964 to demarcate the boundary between the politics and civil service (Dessalegn & Meheret, 2017).

Despite proclaiming the merit-based civil service system, the result was far from a Weberian ideal-type bureaucracy and political loyalty, relationships with the ruling class were used as the major criteria for recruitments and promotions of civil servants (Markos, 2013). Fundamental change had not been made on the civil service system during the socialist military regime (1974–1991) (Kassa, 2011).

The Ethiopian People’s Democratic Revolutionary Front (EPRDF) 1991 had taken various measures since it seized power (1991) to address the long-standing problems within the civil service administration. Transferring the political and administrative authority from central government to regional states and its lower tiers to improve the efficiency of public service delivery was the first reform undertaken by EPRDF-led government. The civil service reform programme (CSRP), which aimed to amend civil service laws and codes of ethics, set up complaints-handling procedures, and the adoption of a new service delivery policy was the second reform. The third phase of the reform was a public sector capacity building support programme (PSCAP). The reform tools such as Business Processing Reengineering (BPR), management by objectives (MBOs), the integrated performance management system (IPMS) and the balanced scorecard (BSC) put the PSCAP into action. Both CSRP and PSCAP established the legal framework for merit-based civil service system. Specific laws, such as the Civil Servants Proclamation No. 515 (2007), FDRE (2007) and its revised versions (2017 & 2024), provided the legal basis for merit-based recruitment, promotion and capacity building.

Although there have been several attempts by different authors (Assefa, 2008; Kassa, 2011; Markos, 2013) to address the implementation of post-1991 civil service reforms, most of these studies have focused on the implementation of reform tools such as BPR or BSC from a top-down perspective. Thus, these studies have not attempted to critically address the informal reality of political interference. Although there have been some attempts by other authors (Assefa, 2021; Dessalegn & Meheret, 2017) to recognise the role of political interference in the Ethiopian context, there is a significant gap in understanding the role of patron-client networks. Thus, by shifting the focus from the perspective of the state to the lived experiences of the

civil servants, this research critically examines the implementation of meritocratic principles through informal means of collusion in the Amhara Regional State.

To systematically address this gap, this study is guided by the following specific research questions:

RQ1: How do civil servants in the Amhara National Regional State perceive the role of meritocracy in contrast to political and personal interference in their recruitment, promotion, and training?

RQ2: What specific mechanisms (e.g., testing, lottery, party loyalty) facilitate political and personal interference in the human resource management of civil servants in the Amhara National Regional State?

RQ3: What factors, including socio-demographic and organisational variables (e.g., job positions, years of service), significantly affect civil servants' perceptions of politicisation in the civil service system in the Amhara National Regional State?

Theoretical frameworks

The boundary between politics and public administration has been heavily debated. Wilson advocated for the separation of politics and public administration (McCandless & Guy, 2013). As believed by Wilson, political officials are responsible for policy formulation while public administrators execute the policies. Weber also shared the views of Wilson and argued that politicians are responsible for setting policy goals while administration is tasked with the technical, day-to-day implementation without partisan bias. In the contemporary world, the distinction between politics and public administration has been increasingly questioned. McCandless and Guy (2013) and Svava (2016) argued that administrators and political leaders constantly influence each other in policy and governance and thus there is not a clear boundary between them. Regardless of their different perspectives, both classical and contemporary theories maintain that public administration should be insulated from political pressures to ensure impartial and efficient governance.

Despite long-held support from public administration theorists, the establishment of independent public administration has not been fully achieved in many developing countries (Dasandi & Esteve, 2017). As per Dasandi and Esteve, there are four models of political-bureaucratic relations from an autonomous perspective: integrated, intrusive, collaborative, and collusive.

The integrated model is characterised by clear role separation between politicians and bureaucrats. This model, rooted in the principles of Max Weber's bureaucratic theory, is a normative ideal where bureaucrats are seen as subordinate executors of policy, while politicians represent of public or public interests. The recruitment and promotion of civil servants is meritocratic. The political affiliations and personal connections do not have any place during civil servants' recruitment and promotion.

The intrusive model is contrasted with an integrated model. The levels of bureaucratic autonomy under intrusive model are often low because of political interference in the day-to-day work of civil servants. Politicians have generally been able to assert their control over the civil service. This control often occurs through political interference in recruitment and promotions. The countries with intrusive

political bureaucratic relations are developing countries where there is frequent political change linked to competitive elections.

The collaborative model is the third type of politic-bureaucratic relationship where political and bureaucratic elites work in close cooperation (Dasandi & Esteve, 2017). Under the collaborative model, civil servants' recruitment and promotion are based on competence, skills, and qualifications rather than favouritism. This type of model is observed in the countries where politicians and bureaucrats operate with a high degree of integration and shared vision (Dasandi & Esteve, 2017).

The collusive model is the fourth model which is characterised by low bureaucratic autonomy, where administrators have little freedom to perform their duties without political interference. In countries where there is a collusive model, recruitment and promotion is based on loyalty to politicians (Dasandi & Esteve, 2017). And the countries which have this type of politics-bureaucracy relationship are developing countries with weak democratic administrations.

Since Ethiopia has a weak democratic administration, the relationship between the public administration and political offices assumed to have the collusive kind of relationship. As stated by Gebrehiwot (2025), the bureaucracy of the country has long been subordinated to the political office. Thus, the relationship between political and bureaucratic system of Amhara Regional State, (which is one of the 12 ethnically-based regional states of Ethiopia), is assumed to be a collusive model. In other words, the bureaucratic system has limited freedom to recruit and promote civil servants and conduct continuous professional development trainings. Political appointees would have heavy influence over recruitment, promotions, and trainings of civil servants to enforce political conformity.

Nonetheless, there is a critical nuance in applying the collusive model in developing democracies. Most uses of the collusive model in bureaucracy assume uniformity in political subordination across different administrative tiers. This study is a critical departure from these assumptions in that we argue that political subordination is not uniformly felt across the bureaucracy. We propose a hypothesis in which civil servants' hierarchical positions as managers and professionals in the bureaucracy differentially perceive a collusive reality. As a result, this research is a critical extension of a more descriptive application of bureaucracy models in testing how the politics-administration dichotomy is split along internal organisational divisions.

Methods and materials

Description of the study area

The Amhara National Regional State (ANRS) is among the largest regions of Ethiopia. The region spans around 154,709 square kilometers. It is the country's second most populous region, with over 23 million inhabitants, and spans a variety of geographic landscapes from the cradle of the Blue Nile Lake Tana to the Semien Mountains – both of which are UNESCO World Heritage sites. It is also home to world cultural and religious attractions such as Lalibela's rock-hewn churches and the imperial city of Gondar.

Organisationally, ANRS is structured in a decentralised hierarchy with 12 administrative zones, 3 special zones, over 160 rural *woredas* (*a district-level admin-*

istrative unit, composed of several kebeles) and city administration, and thousands of kebeles (smallest local administrative subunits). The public services have been provided by the different tiers (regional, zonal, *woreda*, city and kebele level) of the regional state. Based on the data obtained the bureau of civil service, about 417,368 civil servants were employed across various tiers of the regional government.

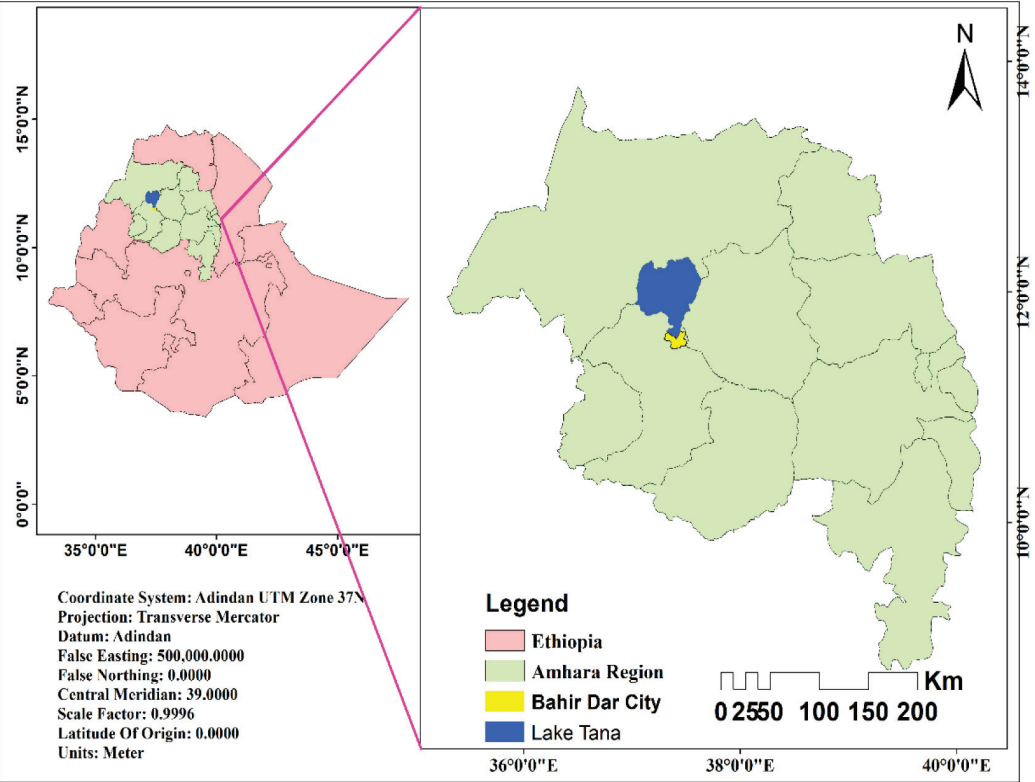


Figure 1. Study area map

Research approach and design

This study employed a mixed methods research approach, and concurrent research design was employed to triangulate the data collected through one data collection approach by the other data collection instruments. A concurrent research design is mixed-research approach which involves collecting and analysing both quantitative and qualitative data simultaneously, often with the goal of triangulation and a more comprehensive understanding of the research problem (Asimov & Blohm, 2024).

Sample size and sampling techniques

Given the impracticality of studying all tiers, the focus of the study is narrowed to 48 regional-level institutions employing 7,000 civil servants. 258 civil servants were selected from different bureaus, agencies and commissions. Yamane's (1973) formula was used to determine the sample size. The following steps were followed to select the sample civil servants. First, seven bureaus, commissions, or agencies including Finance and Economy, Trade and Market, Revenue, Industry, and In-

vestment, Work and Training, and the Civil Service and Plan Commission were selected from 48 regional-level institutions. These specific seven institutions were purposively selected in that they represent a diverse cross-section of the regional government's core functions, which include financial management, economic regulation, social development, and central personnel management. Furthermore, these institutions were selected on account of their high rate of civil servant employment, recruitment, and training, which makes them highly relevant in terms of examining the interface of politics and bureaucracy. Secondly, sample civil servants were selected from seven selected institutions. A systematic sampling technique was employed to select the sample civil servants. The sample civil servants were proportionally divided among the seven sample institutions to obtain the sample size for each public organisation.

Data collection methods

Questionnaire survey

A questionnaire survey was conducted from first week of mid- December in 2024 to the end of January 2025. The survey was designed to assess the perception of civil servants on the practices of merit-based recruitment, promotion and training. The questionnaires were designed to record the profile of civil servants, recruitment process, the promotion procedures and their views on capacity building of civil servants. The questionnaires were written in English and then translated into Amharic to ensure ease of communication with the respondents. They were also pre-tested on 20 civil servants working in the Bureau of Finance to confirm that the questions were unambiguous. The Cronbach alpha was also calculated to measure the internal consistency and reliability of the questionnaire's items and it was found that the reliability of questionnaire items are acceptable, with a score typically being 0.7 or higher.

Key informant interviews (KIIs)

Interviews were conducted with 14 key informants (KIs), comprising deputy bureau heads, human resource management directors, and higher experts. The objectives of the interviews were (1) to triangulate the data generated through the questionnaire survey and (2) to gather information that could not be captured through the questionnaire survey. Key informants were selected from the sampled institutions based on their experience and decision-making authority. The issues explored during the KI interviews included (1) the practices of merit-based civil service recruitment, promotion, and capacity building in their respective institutions and (2) the level of bureaucratic and administrative autonomy in civil service recruitment, promotion, and training. The interviews were conducted using a checklist as a memory guide and were audio-recorded with the consent of the key informants. Notes were also taken during the interviews to capture important cues and relevant points.

Focus group discussions (FGDs)

Three FGDs were conducted in January 2025 in three sampled institutions to triangulate questionnaire survey and key informant interview data. Each FGD involved seven participants. Working experience and educational level were used as the criteria to select the participants of FGDs. The discussions were focused on: (1) civil ser-

vice recruitment and promotion approaches and its constraints, (2) capacity building and its constraints. The discussion made with each FGD took from 40 to 50 minutes. FGDs were carried out using a checklist as a memory guide; and they were audio-recorded with the participants consent and notes were taken at the same time to capture important cues and relevant points.

Data analysis

Different approaches were employed to analyse the data collected through survey and qualitative data. Thematic analysis was applied to analyse the data collected through KI interviews and FGDs. The analysis started by transcribing KI interviews and FGDs. The transcribed data were then categorised into themes and finally converted to generate the smallest meaningful units. Descriptive statistics were used to analyse the profiles of the respondent, their perception on the practices of merit-based principles in the recruitment, promotion and trainings.

An ordered probit model was used to analyse the factors influencing civil servants' perceptions of recruitment, promotion, and trainings. This statistical method is suitable for ordinal survey responses and helps estimate the relationship between the independent variables and the ordered perception levels. The dependent variables included the perception of respondents on the practices of merit-based principles versus political interference during recruitment, promotion and trainings of civil servants. The perceptions of how civil servants are hired, promoted, and trained based on merit versus political influence were measured using categorically. Sex, years of experience, position classification and level of work position were assumed to influence the perceptions of respondents on the practices of merit-based principles versus political interference during recruitment, promotion and trainings of civil servants. The association between the dependent and independent variables is summarised in Table 1.

Variance Inflation Factors (VIFs) were used to test for multicollinearity among the explanatory variables. The findings of VIFs revealed that there was the multicollinearity problem between the levels of work position (newly employed, junior, senior and executive civil servants) and years of services. Thus, the levels of work position are excluded from the ordered probit regression model.

Ethical approval

The ethical aspects of the research proposal were evaluated and approved by the review committees of the political Science and International Studies department in accordance with the Institution's 2022 Dissertation and Thesis guidelines. After the approval of the review committees, a letter of requesting support was written from the Dean's office of the Social Science Faculty to regional bureaus and then, the permission letters were obtained from sampled regional bureaus.

After obtaining permission from regional bureaus, research participants were fully informed about the purpose of the research, and how the data obtained from them would be used. Informed consents were then requested from respondents, key informants and FGD participants. All participants voluntarily provided their informed consent, ensuring they understood the study and could freely agree to participate without coercion.

Results

Socio-economic and demographic characteristics

The descriptive statistics indicated 52.3% of the respondents were male and 47.7% of them were female. Some 90% of them were married and the remaining were single, divorced or widow/widowed. The mean age of them was 41.45 years, but ranged from 20 to 58 years. About 2/3rds of them were under the age of 36 years. The average working experience of them was 10.44 years, but ranged from 3 to 40 years. Educational backgrounds of the respondents varied from TVET to Master's degrees, with most holding Bachelor's degrees (67.8%) and followed by Master's degrees (31.4%). They were predominantly higher experts (36.8%), followed by team leaders (19.4%) and then junior experts (18.6%). The directors and the clerks comprised 17.4% and 7.8%, of the civil servants, respectively. In terms of employment category, a majority (55.5%) of them worked in professional positions, followed by management positions (30.2%) and administrative position (14.3%).

Perception on recruitment of civil servants

The results of the survey data on the practices of merit principles during recruitment of civil servants are summarised in Table 1.

Table 1

Percentage distributions of the respondents' perception on the practices of merit principles during recruitment of civil servants

No.	Item	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	The examinations for recruitment consist solely of aptitude tests	15.5	39.9	8.5	27.9	8.1
2	Exams test skills and knowledge related to specialisation	10.9	38.0	12.0	31.9	7.4
3	Exams prepared for recruitment are not related to the positions	5.0	31.4	13.2	35.7	14.7
4	Practical exams are common for candidates applying for technical posts	11.2	40.9	13.6	25.4	9.3
5	Exams and interviews are conducted by professional civil servants	17.0	35.5	9.7	27.1	11.6
6	Skills and merits determine employee selection	15.5	34.5	13.2	30.2	6.6
7	Civil servant exams are kept secret until completion	13.6	38.4	13.2	26.0	8.9
8	The exam system fails to recruit the best professionals	10.9	28.3	13.2	33.7	14.9

Sources: Compiled based on the authors' calculations from field survey (- hereinafter also).

The summary table indicated that the respondents had contradictory views on the practice of merit-based principles during civil servants' recruitment. More than half of them perceived that the exams prepared for the recruitment of civil servants are neither related to field of specialisation nor aptitude tests. On the contrary, over 33% of those surveyed considered the exams to be pertinent to available jobs. The implementation of applied tests for vacant technical positions was also debated. A majority (51.1% of respondents) felt technical applicants were not practically assessed, while one-third disagreed with this notion.

Similar to their relevance, the confidentiality of the recruitment exams is also questionable. Although 35.9% of the respondents agreed that the tests were kept private, the majority suspected that the selection exams were not confidential. More than fifty percent of the respondents felt that the appointments were made by non-specialists or individuals without relevant professional expertise.

Table 2 presents the proportion of civil servants who responded to survey items concerning recruitment malpractices and political interferences. The results (over 50% of respondents) indicated the existence of political interference in recruitment though significant number opposed this notion, indicating a divided perspective on the issue.

As perceived by 54% of respondents, nepotism and cronyism were also perceived to be prevalent during the recruitment. Applicants' ethnic origins are also used as criterion in the selection process as perceived by over 55% of respondents though above 1/3rd of them disagreed or strongly disagreed on the usage of ethnic background as the recruitment criterion.

Table 2

The percentage distribution of the respondents' perception on the political and personal interference during recruitment of civil servants

No.	Item	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	Nepotism and cronyism fundamentally undermine merit-based recruitment	5.0	34.9	6.2	31.5	22.5
2	Ethnic background influences employee selection	5.9	31.0	7.8	43.6	11.6
3	Political interference influences employee recruitment	13.5	26.7	6.7	41.0	12.0

KIs had also divergent opinions about political meddling and the actual efficacy of merit-based hiring. The professional expert 8 (PE8) key informant for example perceived the non-existence of political influence on the civil servant's recruitment. He said:

I believe that there are personal biases during civil servant recruitment. I don't also believe that exams enabled recruitment based on candidates' professional credentials. However, I don't believe that political affiliation influences the hiring process

Like PE8, PE3 viewed the non-existence of political interference rather than technical and administrative problems. He expressed his observation in the hiring process as:

A large number of applicants apply for a vacant position. Since it takes time to examine and select all applicants, a limited number of applicants will need to be selected by lottery method. During this time, the likelihood of excluding the qualified applicants from the competition selecting is high.

PE2 disagreed with the notion that there was no political interference and bias in the civil servants' recruitment. He perceived the existence of nepotism or cronyism and political patronage. He explained as:

The candidates, who are members of the ruling party and have actively participated in party activities, had been selected in advance of any assessments. Supposedly, all candidates would be evaluated. This only happened when there are party members among the applicants. Relationships also took precedence over actual merit in addition to political affiliation.

The existence of political interference was also viewed by PE7. PE7 expressed his observation regarding the preferential opportunities offered to the ruling party members as:

Over the past three decades, partisan influence has shaped the selection process of civil servants. Party affiliation was a de facto criterion for preferential treatment in applicant selection and thus, secondary school and university students had to become the ruling party member whether they believed it or not to be employed.

Promotion of civil servants

Table 3 presents the percentage distribution of respondents' perception on civil servants' promotion practices.

Table 3

The percentage distribution of respondents' perception on civil servants' promotion practices

No.	Item	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	Civil servant promotion is based on merit through open competition	18.1	38.8	3.9	32.6	6.6
2	Team leaders and directors are usually ruling party members	12.5	27.9	7.4	37.9	14.2
3	Officials prioritise connections over performance in promotion	10.5	33.7	6.9	35.0	14.0
4	Governing party-affiliated civil servants get more promotions	4.3	32.9	8.9	38.0	15.9

The summary table indicates that a majority (56.9%) of respondents doubted that civil servants' promotion based on merit through open competition like recruitment. As per nearly half of respondents, personal networking determined the

promotion of civil servants rather than their performance. Affiliation with the ruling party was also crucial for career advancement among civil servants as perceived by 53.9% respondents although a substantial minority (over a third) disagreed with this notion. Specially, membership in the ruling party is a prerequisite for achieving leadership (team leader and director) positions based on the narrow majority of respondents.

The KIs had also divergent of opinion on the practices merit-based principles during promotion. The KI (P13) of one of sample institutions disagreed on the notion that civil servants' promotion hinges on nepotism and political loyalty. He expressed his view on the promotion process as:

I cannot claim that promotions are solely based on a candidate's abilities and accomplishments. A promotion may be decided based on subjective criteria rather than purely on an employee's objective performance. However, I don't believe that connections to the ruling party and officials determine the promotions of civil servants.

Another KI (P3) also disagreed on the politicisation of civil service promotion. However, he did not deny the influence of personal connections. He said:

The notion of open competition for civil servant promotion is a superficial gesture, as appointments are not based on merit. Promotions are frequently determined by personal connections and the influence of leadership especially for the professional and administrative positions.

The senior expert informant (PE9) refuted the notion of non-political interference in the promotion of civil servants. He described his observations on the politicisation of civil service process as follows:

You don't necessarily have better management skills or professional quality to be department heads or director of offices. The practical ability of civil servants to handle technical and administrative duties was not a factor in their promotion to managerial positions. The only requirement for promotion to a position of heads or director is to be a member of the ruling party and be loyal to achieving the party's goals.

Civil servants' training selection

Since 1991, civil servants have participated in various short-term training initiatives designed to strengthen their professional competence. These trainings have been provided from one day to a month by regional and federal government agencies, NGOs, and international organisations. Additionally, long-term trainings have been offered to enhance their academic qualifications. Nearly two-third of the respondents had received short-term training for the last five years. The rest (34%) had never got an opportunity to attend short-term trainings. In addition, they have been sent abroad for short-term training and experience sharing, though the number of attendants was insignificant (6%). Almost 2/3rds of the respondents who received training opportunities attended from 1 or 2 training sessions (Fig 2). The percentage of trainees participated at 3 to 4 and 5 or more training sessions was 28% and 7%, respectively.

In terms of position classification, over 90% of the managerial civil servants and approximately 60% of the professional experts participated in the short-term

training. Short-term training participation was considerably lower for civil servants in administrative roles compared to those in managerial and professional expert roles. Figure 3 shows that civil servants in leadership roles had superior short-term training prospects compared to their peers. Over 55% of them had participated in a minimum of three training sessions which was significantly higher than the corresponding figure (22.6%) of professional experts. On the contrary, most professional trainees (77.4%) and all administrative civil servant trainees participated in a maximum of two short training events during the past five years (Fig. 3). Managerial civil servants had also better access (75%) to international short-term training and shared experiences compared to their professional and administrative counterparts.

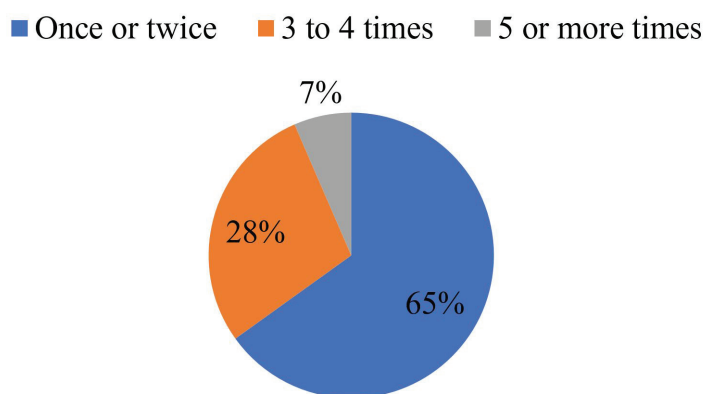


Figure 2. Percentage distribution of participants based on their number of training sessions attended

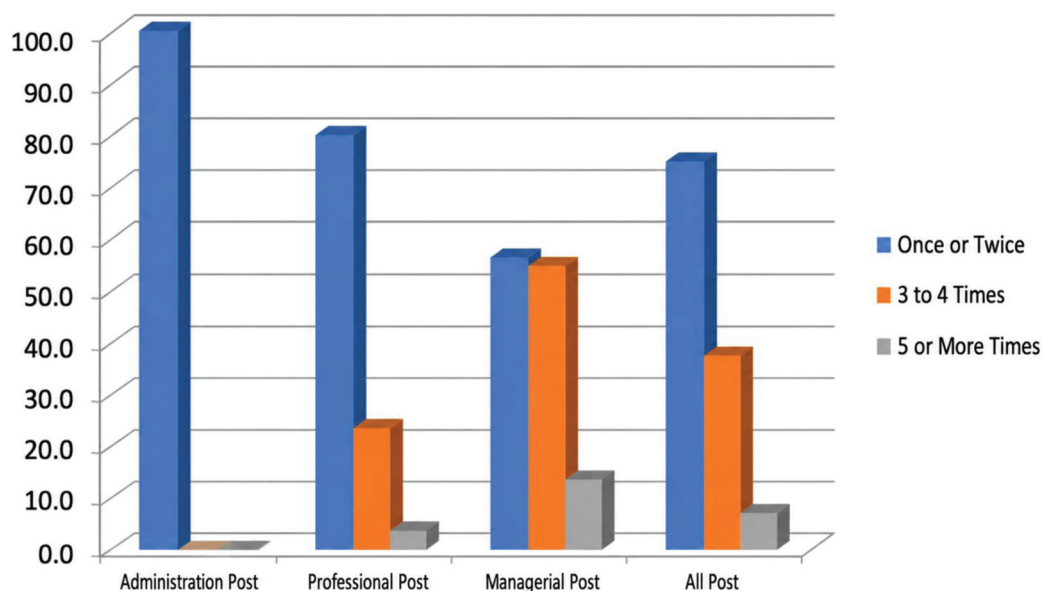


Figure 3. Percentage distribution of participants based on their number of training sessions attended and job structure

The percentage distribution of the respondents' perception on the practices of merit-based principles presented in the Table 4 shows that more than 60% of respondents felt short-term domestic and overseas trainings failed to adhere to established human resource development protocols, though nearly one-third held a different view.

Almost 60% of respondents also expressed that the short-term trainings were not been designed to address specific skill deficiencies or enhance performance in public service delivery. Thus, short-term trainings offered so far have not augmented the professional competence of civil servants as perceived by nearly two-third of the respondents.

Table 4

The percentage distribution of the respondents' perception on the practices of merit-based principles during civil servants training

No.	Item	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	Civil servant training follows human resource development HRD guidelines	23.2	38.0	6.2	19.8	12.8
2	Short-term training aligns with civil servants' roles	22.4	36.8	4.7	31.4	4.7
3	Short-term training has boosted civil servants' competence	18.2	46.0	4.5	19.4	12.0
4	Our office provides equal long-term training opportunities for all employees	18.6	36.8	8.1	29.5	7.0
5	Long-term training is based on performance and experience	25.5	37.6	5.9	27.0	3.9

Similar to short-term trainings, over 63% of respondents perceived that long-term trainee selection has failed to consider the performance, experience, and the specific training requirements needed for their professional growth. Over 55% felt that civil servants had not been granted impartial access to long duration training programmes. Party-affiliated civil servants have received more training opportunities than non-affiliated peers as per the views of nearly 60% of respondents (Table 5).

More than 55% of respondents believed that the financial gain from per diem payments motivates prioritising ruling party members for short-term participations, rather than genuine professional development. Similar to short-term trainings, there was a political interference in the selection of candidates for long-term civil servant trainings as perceived by over 60% and thus, the politically loyal civil servants have obtained more long-term training opportunities compared to their non-party colleagues.

Table 5

The percentage distribution of the respondents' perception on the political and personal interference during civil servant trainees' recruitment

No.	Item	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	Political influence affects short-term training selection	2.7	32.9	10.7	36.8	16.9
2	Civil servants get short-term training mainly for per diem benefits	7.0	31.0	7.8	40.0	15.2
3	Party-affiliated civil servants receive more short-term training than non-affiliated peers	2.9	30.9	7.4	42.4	17.4
4	Politically loyal civil servants get more long-term training opportunity	4.3	27.5	6.0	37.6	34.6
5	Political leaders influence selection for long-term training abroad	5.0	22.0	8.5	41.8	22.5

Like the survey participants, the key informants and FGD participants had different perspectives on the provision of short- and long-term training provided to civil servants. For instance, FGD1 argued that the provision of short-term training for civil servants has gone awry of its targets. In their discussions, they clarified that:

The primary motivation for attending short-term training was to collect the daily allowances (per diem). *Consequently, the participation in short-term trainings was perceived to be a reward or entitlement rather than the tools for the professional competence development.*

An undue emphasis on earning daily stipends instead of professional development has led to an inequitable provision of civil servants' short-term trainings. Regarding this, PE2 explained his observation as follows:

Officials holding management positions and political figures are more actively engaged in the short-term trainings. High per diem will tempt them to prioritise their own interests, regardless of the type of training they have received before. They only permit senior civil servants or their associates to attend the trainings when vital duties prevent their attendance.

The short-term training opportunities were often not publicly known to ensure the primary involvement and benefit of political figures and managers and hence majority of civil servants were excluded from the short-term trainings. The expression of PE5 illustrates how certain government employees were disadvantaged:

Civil servants, who criticise the ruling party and government administration system, are subject to significant influence from officials and political leaders. They have frequently been denied the continuous professional development and financial advantages resulting from training programmes.

The long-term trainings have also been suffered from the problems of inherent bias and inadequate planning similar to short-term trainings. The 2nd FGD partici-

pants reflected their views concerning the partiality and disorganisation of long-term training as:

Civil servants' long-term trainings opportunities are not linked to educational qualification and performance. The public officials, ruling party members and loyalists, and persons networked with officials whose prior education doesn't align with their new specialised roles received long-term training opportunities.

Overseas education opportunities were totally denied to non-party members and civil servants raising objections to government actions. They have also been rarely extended to the ruling party members or closely affiliated with the authorities. The 3rd FGDs described regarding overseas long-term trainings opportunity as:

Overseas education opportunities have not been publicised to civil servants. Political officials have maintained it clandestinely. The primary reason is to prevent rivalry for limited positions. Thus, political and public leaders are exclusively granted access to foreign educational programmes.

PE2 PE8 rejected others perspective on the disorganised and unequal provision of short- and long-term trainings. He disagreed with the objections made by others regarding the training accessibility as follows:

Usually, training opportunities have been equitably provided to all civil servants and the aim of the short-term trainings is not for financial gain. The goal of training is still professional development.

Factors influencing the perception on the recruitment, promotion and trainings of civil servants

Among a total 11 explanatory variables that hypothesised to influence civil servants' views, five of them were found to be statistically significant. The ordered probit model output presented in supplementary Table 6 shows that managerial position had statistically significant influence on the civil servant's perception on the merit-based practices versus political interference in the recruitment, promotion and trainings at a statistically significant level ($p < 0.01$). The managerial position had positive relationship with the merit-based recruitment, promotion and trainings, whereas it had negative relationship with political interference and personal relation. The positive association between managerial position and merit-based practices suggested the positive view of civil servants in managerial roles perceived on the recruitment, promotion, and training processes. On the other hand, an inverse relationship between managerial position and perceived political interference points out the less likely of civil servants in managerial roles to perceive political interference in hiring, promoting, and training staff.

Duration of service was another factor that had a statistically significant impact on their view of merit-based hiring and promotions, as well as political meddling at a statistically significant level ($p < 0.10$). The relationship between duration of service and perception of merit-based hiring was negative. This suggested that a civil servant's perception of merit-based practices declines as their tenure increases. On the contrary, the positive association between the duration of service and perception of political meddling in hiring suggests that civil servants with greater seniority tend to have a higher perception that political influence undermines hiring decisions based on merit.

Table 6.

Ordered probit model estimates of the civil servant's perception on the merit-based principles versus political meddling of recruitment and promotion

Variables	MERITRECRU			POLRECRU			MERITPROM			POLITPROM			MERITTRAIN			POLITICTRAIN		
	Coef.	Std error	P value	Coef.	Std error	P value	Coef.	Std. error	P value	Coef.	Std error	P value	Coef.	Std error	P value	Coef.	Std error	P value
SEX	-.2250	.1456	.02**	.0503	.01434	.73	0.0670	.1490	.65	-.1001	.1542	.52	.2150	.1471	.14	.0854	.1369	.533
EDUCLEVEL	-.0209	.1592	.90	-.1460	.1577	.35	.1185	.1635	.47	-.0110	.1697	.95	-.3345	.1628	.04**	.0773	.1509	.609
ADMINPOS	-.7435	.6213	.03**	-.4040	.5810	.49	-.2815	.5989	.04***	.3058	.6088	.02**	-1.1349	.5767	.05*	.0292	.5304	.056*
PROFESSION	.4953	.5907	.40	.1577	.5513	.08*	-.8878	.5716	.02**	.1789	.5757	.06*	-.2820	.5377	.60	.1556	.4997	.052*
TECHNICAL	.3423	.2355	.15	-.1390	.2236	.53	-.0803	.2306	.73	.1755	.2366	.46	.0922	.2198	.68	-.0987	.2077	.635
MANAGMEN	4.1584	.6769	.00***	-3.4756	.6015	.00***	2.9199	.6261	.00***	-3.3370	.6271	.00***	2.8644	.5752	.00***	-.1086	.4975	.027**
YEARSERV	-.0178	.0097	.07*	.0158	.0096	.10*	-.0042	.0099	.67	.0143	.0103	.10*	.0100	.0099	.31	-.0038	.0091	.676

Source: Calculated based on survey data.

Note: * =significant at p<0.1; ** =significant at p<0.05; *** =significant at p<0.01.

MERITRECRU=merit-based recruitment; EDUCLEVEL=educational level;
POLRECRU= political-based recruitment; ADMINPOS=administrative position;
MERITPROM=merit based promotion; PROFESSION=professional position;
POLITPROM=political based promotion; TECHNICAL=technical position;
MERITTRAIN=merit based training; MANAGMEN=managerial position;
POLITICTRA=political based training; YEARSERV=year of service.
SEX=sex;

Professional position was also the significant variable that determined the perception of civil servants on the merit-based practices versus political interference. It had positive relationship with the perception of political meddling in the recruitment, promotion and trainings; whereas its relationship with the perception of merit-based promotion was negative. A positive correlation between a professional position and the view of political interference indicates that civil servants in professional roles feel recruitments, promotions and trainings are based on political connections rather than merit.

Administrative position significantly influences civil servants' views on recruitment, promotion, and trainings as well. The views of civil servants on the merit-based recruitment and promotion had negative association with their administrative position. This suggested that administrative civil servants perceived the recruitment and promotion processes as lacking a meritocratic basis. The administrative position, on the other hand, had a positive relationship with the views on the political meddling promotion and trainings. This suggested that administrative personnel in the civil service perceive that political influence exerts a powerful effect on their upward mobility and professional trainings.

Discussions

Civil servant recruitment practices

Meritocracy in public service is crucial for building a more competent, accountable and trusted government by ensuring that offices are filled based on qualifications, skills, and performance (Brewer & Rainy, 2022). Ethiopian governments have acknowledged the importance of a meritocratic civil service by enacting laws that mandate recruitment and promotion based on objective criteria (FDRE, 2007; 2017 & 2024). Our findings, however, revealed that civil servants' recruitment in ANRS has significantly deviated from theoretical underpinnings of public administration theories. Despite their varied views, the participants acknowledged the failure of hiring based on merit-based approach. The futility of the recruitment tests was one of the principal factors for failure of merit-based recruitment. A majority of respondents viewed that the tests were not relevant to the specific vacant posts which is consistent with the findings of some previous studies (Kuipers, 2023; Nkgapele & Mofokeng, 2024). Irrelevant hiring assessments compromise meritocracy and result in a less-skilled workforce and an inefficient bureaucracy (Kolvani & Nistotskaya, 2025; Sundell, 2014). Similar to other developing countries (Ukeje et al., 2020), the personnel offices often lacked the capability to develop specific testing methods that align with the unique requirements of each post to effectively recruit qualified applicants.

The HR departments' inability to handle all applicant tests was also seen as a constraint for merit-based recruitment. It was noted during KI interviews that HR departments have shortlisted the applicants who would take the recruitment test. The applicant pool, however, was not properly narrowed down using initial screening criteria like academic performances which is contradictory to the findings of the previous studies (Cole et al., 2007; Moore et al., 2023; Siraj et al., 2011). Cole et al. (2007) and Moore et al. (2023) reported that filtering from the applicant

pool before moving on to subsequent stages like interviews and skills assessments has been carried out based on a candidate's experience and qualifications to decrease the possibility of hiring underperforming individuals.. As reported by KI interview and FGDs, the lottery method has been used to select the final candidates for the recruitment tests. The measurable standards have not been used to shortlist the applicants who would take the recruitment test. Even though the lottery method could avoid the biases, the screening of candidates based on chance rather than objective criteria unfairly excluded qualified individuals (Moore et al, 2023). However, from an administrative perspective, some key informants pointed out that the use of the lottery method and other screening tools is often a pragmatic response, albeit imperfect, to the sheer volume of applicants and resource constraints, rather than a strategy to circumvent meritocracy.

The intention of creating a civil service system loyal to the ruling party was another major obstacle in exercising merit-based principles. The majority of participants witnessed the recruitment of politically loyal applicants rather than using objective criteria. The professional and administrative civil servant KIs also confirmed the preferential treatment of the ruling party members over non-member applicants. Markos (2013) also reported that political loyalty and relationships with the politicians were used as the major criteria for recruitments of civil servants in pre-1991 period. The challenge of neutralising the hiring of civil servants from political interference was also the major problem of different countries (Rougier, 2015).

In addition to political loyalty, the ethnic background and gender of the applicants have been used as the selection criteria of civil servants. Our findings reported that priority has been given to ethnic minority and female applicants which is contradictory to the proclamation No. 515/2007 Article 13 (1) and its revised proclamations FDRE (2017 & 2024). The proclamation stated that recruiting civil servants based on their ethnic origin, sex, religion, political outlook, disability or personal connection is strictly prohibited. The justification of the region for prioritising minority ethnic and female applicants is to create a more diverse, inclusive, and equitable civil service. The FGD participants perceived that the improper implementation of affirmative action has contributed to the exclusion of highly competent majority ethnic group applicants (the Amhara ethnic group).

On the other hand, supporters of these measures and government narratives argue that these measures, though apparently undermining the ideal of Weberian meritocracy, are necessary and transitional steps to dismantle historical inequalities and construct a more representative bureaucracy (Beagan et al., 2024). Previous studies (Beagan et al., 2024; Park & Liang, 2020; Sunam et al., 2022) also reported the negative effect of affirmative actions in building merit-based bureaucratic systems. According to these studies, affirmative action has negatively affected the building of merit-based bureaucratic system by potentially lowering personnel quality despite increasing the representation of minorities and addressing historical inequities.

The personal connection was also perceived (54% of the respondents) to be used selection criterion. This clearly demonstrated a breach of the country's civil service regulations. The difficulty of fighting nepotism and cronyism in public sector hiring has also been a documented problem in many countries (Dobrowolski et al.,

2022; Kirya, 2020; Ragauskas & Valeškaitė, 2020). Hiring civil servants based on personal connection hinders the government's ability to deliver public services and implement development policies by creating less competent and less motivated staff, increasing corruption and decreasing the public trust (Batabyal & Nijkamp, 2004; Nasi, 2011; Ukeje et al., 2020).

Civil servant promotion practices

The promotion practices have also deviated significantly from the federal civil service proclamation and administrative theory. The majority of respondents reported that membership or loyalty to the ruling party has been used as the principal criterion for promotion especially to managerial positions despite public officials' claims otherwise. This is contradictory to the Federal Civil Servants Proclamation which establishes a clear legal framework for civil servants promotions based on merit, competence, and performance (FDRE, 2007, 2017, 2024). Historical evidences also indicated that allegiance to previous regimes (Haile Selassie I and Derge) often determined who was appointed to senior roles in the civil service (Markos, 2013).

The politicisation of civil servants' promotion to the senior or managerial positions was also reported in different countries (Lee, 2018; Nahtigal & Haček, 2013; Su & Tao, 2020). Duong (2021) and Su and Tao (2024) observed that political credentials including political virtues and political qualifications were the necessary conditions for the promotion to the managerial positions. The studies of Moynihan (2025), Peters and Pierre (2004), and Peters and Bianchi (2023) which were done in developed democratic countries also showed that civil servants promotion to high public offices could not be free from political decisions. However, educational qualifications, professional experience, and achievements have been used as important criteria to choose from the politically loyal candidates. It was noted during KI interviews and FGDs, however, that professional achievement has not been considered in the promotion of the ruling party member civil servants to managerial positions. Some studies (Duong, 2021; Su & Tao, 2024) observed that despite using political loyalty as a criterion for promotion, it has not affected the building of a strong civil service system. The promotion based on political favouritism over educational qualifications and experience has weakened the ANRS civil service administration. Discouraged by favouritism, highly qualified civil servants have been forced to resign from the region's civil service system. The prioritisation of strong political loyalty to the civil servant's promotion for managerial roles has also compelled the resignation of better qualified and critical party members.

Civil servants' promotion to the higher expert post and supporting staffs are not free from the biases of similar managerial positions. The findings of KI interviews indicated that the promotion of civil servants even to the senior expert and supportive staff positions has violated Weberian principles of a bureaucracy and Human Capital Theory. As per KIIs, the personal relationship and political loyalty have directly or indirectly determined civil servants' promotion to these positions which corresponds with the findings of previous studies (Amosa et al., 2021; Boutaleb & Labzaé, 2022). The KI interview data revealed that civil serv-

ant's promotion to the next level expert or administrative position has been determined based on work efficiency scores and their performance has been judged by their obedience to public and political officials and their attitudinal compliance. This is consistent with the findings of Boutaleb and Labzaé (2022) which reported that the party officials decided the performance metrics of civil servants. This means the efficiency metrics do not fully represent the technical ability, professional skills, or actual job outcomes of civil servants. FGDs and KI interview reported that highly qualified and high-performing civil servants often scored lower job performance ratings compared to their less qualified and less productive counterparts. As reported by Boutaleb and Labzaé (2022), less competent individuals have been promoted to next administrative and professional positions bypassing more capable professional staffs. The effects of such a dysfunctional system of promotions are disastrous (Labzaé, 2022).

Training of civil servants

Continuous professional development trainings are vital for civil servants to enhance their knowledge, skills, and professionalism. Recognising the need for continuous trainings, the Federal government has enacted a decree to provide ongoing professional development trainings for the civil servants (FDRE, 2007, 2017, 2024). In accordance with the proclamation, both short-term and long-term training opportunities have been made available to civil servants across various government offices. In line with trainings, workshops and conferences have been held to enhance the knowledge and skills of civil servants. The survey data revealed that civil servants had received short-term trainings. The short-term trainings, however, failed to align with the objectives set forth in the Federal Civil Service Proclamations. It was noted that the primary aim of short-term trainings' participations was to receive the daily allowance (per diem) which is consistent to the findings of Tostensen and Søreide (2016) which reported that short-term trainings have become a way of supplementing civil servants income with per diem.

Since short-term training has been directly tied to financial benefits, the selection process was no longer based exclusively on identifying and filling skill gaps. This is inconsistent with the provisions of Federal Civil Servant Proclamation No. 515/2007 Article 57 (2) and No. 1353/2024 Article 22 (2) which stated that training participants' selection should be guided based on existing knowledge and skill gaps analysis. The survey data, however, reported that the training participants' selection was conducted based on loyalty to the ruling party, personal ties with public and political officials and the ruling party membership. The same criteria were also used for the selection of civil servants who would participate in the paid workshops and conferences.

On the contrary to Proclamation No. 1353/2024 Article 22 (3), the professional background and working position of participants were not considered in deciding who would be attending the short-term trainings, workshops, and conferences. Frequent attendance by public and political officials was common even though their professions were not directly related to the sessions. This demonstrates that public officials the frequent attendance of public officials compared to other civil servants. The findings of U4 Anti-corruption Resource centers (2016) which reported that

the officials in three countries (Ethiopia, Tanzania and Malawi) have used the trainings, conferences, and workshops for their own benefit rather than to develop the skills of civil servants (Tostensen & Søreide, 2016).

Per diem-focused trainings, workshops, and conferences have yielded negligible results in enhancing the professional skills of civil servants. Over 55% of respondents and the professional experts' key informants perceived the failure of the trainings in upskilling and reskilling, enhancing the innovation and adaptive capacity, supporting of the career advancement for civil servants and making them more efficient in their roles, which is inconsistent with the findings of Pallai and Gregor (2016) which reported the trainings offered so far for civil servants contributed to the development of their skills and significantly change their attitudes. The ineffectiveness ongoing professional development has serious implications on public service delivery and implementation of socioeconomic development plans of the region. Nor (2025) reported that civil servants, whose professional skills are not developed and their attitudes are not changed through continuous professional training, could not contribute to the efficient public service delivery and effective development policies implementation.

Limitations of the study

Several limitations exist with regard to the present study, which provide scope for further research. First, the perceptions provided by the civil servants are self-reported, which raises the possibility of social desirability and attribution biases. Employees who did not attain promotions or training opportunities might be more inclined to attribute the lack of such opportunities to the interference of politics rather than the lack of competence on their part. Secondly, the present study is restricted to the Amhara National Regional State. The Ethiopian landscape is ethnically diverse, with the government divided into various regional states. The interface between the realms of politics and bureaucracy might be significantly different in the various regional states, which limits the generalisability of the present study. Thirdly, the cross-sectional nature of the survey data, along with the ordered probit model, permits the identification of significant relationships but does not provide scope for establishing causal relationships between the various socio-demographic attributes and perceptions of the civil servants.

Conclusions

Ethiopian governments have declared to establish merit-based civil service system by implementing reforms. This study examines whether the ANRS has exercised merit-based hiring, promotion and trainings systems other than political connections in the past three decades. Based on our findings, the following conclusions are drawn. First, the practice of merit-based civil servants' hiring was questionable in ANRS. The limited effectiveness of the assessment process, the lack of independent staffing agencies, and political interference contributed to weaknesses in merit-based civil service recruitment. Secondly, the promotions of civil servants were more likely to be influenced by political loyalty to the ruling party and personal connections to public and political officials. The managerial roles were

reserved for civil servants from the ruling political party and those deemed loyal to the politically appointed leadership. Management skills or professional quality have not often been considered during the promotion particularly to managerial positions. Thirdly, the civil servants' trainings were not intended to improve the skills, adaptability, and career prospects of employees, nor were they designed to make them more effective and efficient. Their primary aim was to receive the daily allowance. Fourth, an ordered probit analysis indicated that civil servants in professional and administrative roles were dissatisfied with hiring, promotion, and training systems, while their counterparts in managerial positions did not share this view. This suggests that public officials are not ready to address the fundamental problems of the existing problems. In general, the relationship between politicians and the civil service in ANRS is characterised by a collusive model which is contradictory to the Weberian principles of a bureaucracy. The practices against the merit-based principles have serious negative consequences for a region's service delivery and socioeconomic development.

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