DIGITAL TRANSFORMATION AND ADMINISTRATION INNOVATION

Citation: Fathi, B., Rahimi, G., & Nejhad Haji Ali Irani, F. (2025). Quantitative Analysis of Factors Affecting the Realization of Smart Government in Iran with Emphasis on the Dimensions of Digital Governance. *Digital Transformation and Administration Innovation*, 3(1), 1-11.

Received date: 2024-09-23 Revised date: 2025-01-22 Accepted date: 2025-01-28 Published date: 2025-03-01

Quantitative Analysis of Factors Affecting the Realization of Smart Government in Iran with Emphasis on the Dimensions of Digital Governance

Babak Fathi[1], Gholamreza Rahimi[2]*, Farhad Nejhad Haji Ali Irani[2]

1. PhD Student in Public Administration, Bonab Branch, Islamic Azad University, Iran
2. Assistant Professor, Department of Public Administration, Bonab Branch, Islamic Azad University, Iran

***Correspondence**: gholamrezarahimi@bonabiau.ac.ir

Abstract

This study aims to quantitatively examine the factors affecting the realization of smart government in Iran with an emphasis on the dimensions of digital governance. The research employed a descriptive-correlational survey design and targeted experts and managers in the field of information technology and digital transformation in Iran's public sector. A structured questionnaire was used to collect data from a sample of 384 participants selected via purposive sampling. The instrument measured constructs such as IT infrastructure, digital governance, organizational agility, digital policymaking, and citizen participation. Data analysis was conducted using SPSS and AMOS software. Structural Equation Modeling (SEM) was employed to test hypothesized relationships and evaluate the measurement and structural models. Inferential statistical analysis using SEM confirmed that all hypothesized relationships were statistically significant at $p < 0.001$. IT infrastructure ($\beta = 0.804$, $t = 9.653$), comprehensive service delivery ($\beta = 0.308$, $t = 7.118$), choice provision ($\beta = 0.760$, $t = 9.35$), security ($\beta = 0.809$, $t = 9.39$), goal alignment ($\beta = 0.654$, $t = 12.34$), smart services ($\beta = 0.756$, $t = 7.118$), and other factors such as digital governance, digital roadmaps, and smart interaction showed significant positive effects on the realization of smart government. Digital policymaking and digital governance emerged as the strongest predictors. The model's goodness-of-fit index (GOF = 0.56) indicated a strong overall model fit. The coefficient of determination (R^2) for the final structural model was 0.72, demonstrating high explanatory power. The realization of smart government in Iran is significantly influenced by a combination of digital infrastructure, governance mechanisms, policymaking strategies, organizational agility, and civic engagement. Among these, strategic digital policymaking and robust digital governance play pivotal roles. These findings underscore the need for integrated digital strategies and institutional capacity building to support the digital transformation of public administration in Iran.

Keywords: Smart Government; Digital Governance; Structural Equation Modeling (SEM); Digital Transformation; Information Technology Infrastructure; Citizen Participation.

1. Introduction

The emergence of smart government as a paradigm shift in public sector governance has marked a turning point in the transformation of traditional bureaucratic structures into agile, data-driven, and citizen-centric entities. This transformation, driven by the rapid advancement of information and communication technologies (ICTs), reflects a global movement toward the integration of digital tools into public service delivery, decision-making processes, and citizen engagement mechanisms (Savić, 2022). In this context, smart government refers not only to the deployment of digital infrastructure but also to the reconfiguration of institutional processes, policies, and governance models to accommodate dynamic societal and technological expectations (Anthopoulos & Reddick, 2023). As governments around the world adapt to the complexities of the digital era, the Iranian public sector faces both unprecedented opportunities and enduring structural challenges in actualizing smart governance at scale.

The discourse surrounding smart government is deeply rooted in the convergence of digital technologies—such as artificial intelligence (AI), the Internet of Things (IoT), big data analytics, and cloud computing—with public administration (Kankanhalli, 2019; Wirtz et al., 2019). These technologies facilitate real-time service delivery, predictive policy-making, and efficient resource allocation while enabling participatory governance structures. However, the realization of smart government extends beyond technological integration. It requires a multidimensional alignment of infrastructure, institutional capacity, regulatory frameworks, leadership commitment, and civic readiness (Guenduez et al., 2024; Popescu et al., 2024). The alignment of these dimensions is particularly critical in developing countries where systemic inefficiencies, organizational inertia, and digital divides often hinder sustainable progress.

Recent empirical studies have underlined that smart governance is most effective when it is embedded in a holistic ecosystem of innovation, collaboration, and accountability (Chatfield & Reddick, 2019; Deandra et al., 2024). For instance, the concept of smart government is closely linked to smart city initiatives, as both emphasize interconnectivity, user-centeredness, and transparency (Anthopoulos & Reddick, 2023). Nevertheless, while these concepts are often used interchangeably, they address distinct layers of digital transformation—smart cities at the urban-operational level and smart government at the strategic-political level. A key distinction lies in the policy mechanisms and governance models that underpin the implementation of digital services in the public domain (Sharifian et al., 2021).

The Iranian context, characterized by a centralized administrative apparatus and rapid urbanization, presents a unique case for examining the drivers and constraints of smart government development. Despite notable advancements in e-government infrastructure and digital literacy campaigns, the integration of smart governance principles remains fragmented and inconsistently applied across sectors (Ghaffari et al., 2023; Sharifian, 2018). Challenges such as low inter-agency data interoperability, lack of cohesive digital policies, resistance to organizational change, and limited citizen participation continue to undermine progress. Moreover, concerns over data privacy, cybersecurity, and equitable access further complicate the implementation of inclusive and transparent smart government systems (Raeisi et al., 2024; Raza, 2024).

Numerous studies have pointed to the critical role of institutional leadership and policy coherence in enabling digital transformation in government structures. Transformational leadership, characterized by vision-driven change management and collaborative governance models, plays a pivotal role in institutionalizing smart governance practices (Shakouri-Moghadam, 2018; Shan et al., 2021). In particular, leadership that fosters digital identity systems, cross-sectoral collaboration, and responsive decision-making mechanisms is essential for bridging the gap between technology and governance outcomes (Sharifian et al., 2021). Furthermore, the presence of legal and procedural frameworks for administrative transparency enhances citizens' trust and engagement, which are foundational to smart governance adoption (Raeisi et al., 2024).

International experiences also highlight the importance of adaptive policy frameworks that align digital transformation strategies with local governance realities. For example, in the case of Yogyakarta, the simultaneous implementation of smart government, smart mobility, and smart living policies led to significant improvements in public service quality and user satisfaction (Deandra et al., 2024). Similar outcomes have been reported in Saudi Arabia, where the determinants of smart government system adoption were found to include organizational readiness, policy incentives, and digital literacy among staff (Alajmi et al., 2023). Such findings underscore the need for context-sensitive models that incorporate both macro-level policy variables and micro-level operational practices.

From a theoretical perspective, the smart government model represents a shift from static, top-down bureaucratic governance to dynamic, networked, and data-informed administration (Zhang & Mora, 2023). This shift is increasingly mediated by digital platforms that enable real-time interactions between government institutions and stakeholders, blurring the boundaries between service providers and recipients (Popescu et al., 2024). The conceptual foundation of smart government also entails the integration of IoT-enabled infrastructures, which support automated data collection, monitoring, and analysis for better decision-making (Wirtz et al., 2019). However, for these systems to function effectively, interoperability standards, privacy safeguards, and user accessibility must be rigorously embedded in their design (Kankanhalli, 2019; Raza, 2024).

In the Iranian context, several structural and procedural shortcomings continue to impede the evolution of a fully realized smart government framework. First, there is a need for a unified digital governance roadmap that consolidates fragmented initiatives and provides a clear vision for implementation (Yazdani & Darbani, 2022). Second, the uneven distribution of digital competencies among public administrators hinders the consistent application of smart governance principles. Third, the absence of standardized performance metrics for evaluating the effectiveness of digital services limits evidence-based policymaking (Gholami et al., 2024). Moreover, socio-cultural factors, such as low digital trust and fear of surveillance, influence citizens' willingness to participate in digital governance processes (Shahzad et al., 2024).

Scholars have also emphasized the role of university-government collaborations in advancing smart city and government initiatives. These partnerships often yield knowledge co-production, policy innovation, and capacity building through interdisciplinary research and pilot programs (Guenduez et al., 2024). For instance, joint research on urban resilience, digital identity, and public value creation has led to the design of more inclusive and sustainable digital governance models (Ghaffari et al., 2023; Shan et al., 2021). In Iran, however, such collaborations remain underutilized, and their potential for fostering innovation ecosystems in the public sector has not been fully realized. Against this backdrop, the present study seeks to quantitatively analyze the key factors influencing the realization of smart government in Iran, with a specific emphasis on the structural dimensions of digital governance.

2. Methods and Materials

This study adopted a quantitative, applied research design using a descriptive-correlational survey method to examine the causal relationships among factors influencing the realization of smart government in Iran. The research population consisted of experts, managers, and professionals working in the field of information technology and digital transformation within public sector institutions across Iran. Given the specialized nature of the target group, purposive non-random sampling was employed to ensure the inclusion of participants with relevant expertise and operational experience in digital governance and public service delivery. Based on standard recommendations for structural equation modeling (SEM), a minimum sample size of 200 to 400 participants was deemed appropriate. Accordingly, data were gathered from 384 respondents, which provided adequate statistical power for SEM analyses and ensured representation across different organizational levels and institutional contexts.

To collect data, a structured questionnaire was developed comprising multiple items aligned with the study's conceptual model. The instrument included questions designed to measure key constructs such as IT infrastructure, digital governance, organizational agility, digital policymaking, citizen participation, and the realization of smart government. All items were constructed based on a five-point Likert scale ranging from "strongly disagree" to "strongly agree". The content validity of the questionnaire was assessed through expert review to ensure relevance and comprehensiveness of the items. Reliability was examined using Cronbach's alpha, with all constructs showing alpha coefficients above the 0.70 threshold, indicating acceptable internal consistency. Furthermore, composite reliability (CR) and average variance extracted (AVE) values confirmed the convergent validity of the measurement model. Items with low factor loadings were excluded from the final analysis to enhance model integrity.

Data analysis was conducted in two phases. The first phase involved descriptive statistics such as means, standard deviations, and frequency distributions to describe the demographic profile of the respondents and summarize the responses to the research variables. The second phase focused on inferential statistics, starting with Pearson correlation and multiple regression analyses to explore associations among variables. The main analytical approach was structural equation modeling using AMOS software, which enabled the simultaneous assessment of direct, indirect, and mediating relationships within the hypothesized conceptual model. The model's measurement and structural components were evaluated using standard goodness-of-fit indices, including composite reliability, AVE, t-values, and path coefficients. The overall model fit was confirmed through the Goodness-of-Fit index (GOF), with a value of 0.56, indicating a strong explanatory model. The coefficient of determination

(R^2 = 0.72) further demonstrated the model's capacity to account for a substantial proportion of the variance in smart government realization.

3. Findings and Results

The demographic profile of the study's 384 participants revealed a diverse sample of experts and professionals in the field of information technology and digital transformation within the Iranian public sector. In terms of gender, 60.7% (233 individuals) were male and 39.3% (151 individuals) were female. Regarding age distribution, 6.3% were under 30 years old, 52.1% were between 30 and 40 years old, 20.3% were aged 41 to 50, 13.8% were between 51 and 60, 6.0% were in the 61 to 70 age range, and 1.6% were over 70 years old. Educational attainment was relatively high, with 7.3% holding a diploma, 19.3% an associate degree, 11.7% a bachelor's degree, 38.5% a master's degree, 18.0% a doctoral degree, and 5.2% possessing a postdoctoral qualification. This distribution reflects a well-educated and professionally mature respondent pool, enhancing the credibility and relevance of the data collected for analyzing the factors influencing the realization of smart government.

The frequency of responses to the items related to the "Smart Government" variable (including mean, mode, standard deviation, and number of responses for each Likert scale option) is presented in Table 1.

Table 1. Frequency of Responses for the Smart Government Variable

Questionnaire Item	Mean	Mode	Std. Dev.	1	2	3	4	5
Smart Services	3.294	3	1.006	20	54	143	127	40
Smart Environment	3.438	4	0.991	13	51	126	143	51
Smart Security	3.305	3	0.947	13	52	164	115	40
Smart Interaction	3.523	4	0.993	16	34	126	149	59
Smart Resources	3.635	4	0.955	9	39	99	173	64

Table 1 shows the descriptive statistics related to the Smart Government variable, indicating the number of respondents who selected each option for each indicator. As shown, the mean scores of this variable exceed 3 (the theoretical mean), indicating that respondents tend to choose "agree" and "strongly agree."

Table 2 presents the descriptive statistics for the "Transformational Digital Leadership" variable, showing the number of responses per option for each item.

Table 2. Frequency of Responses for the Transformational Digital Leadership Variable

Questionnaire Item	Mean	Mode	Std. Dev.	1	2	3	4	5
Digital Structuring	2.873	3	1.084	62	72	146	90	14
Digital Governance	3.695	3	1.014	55	76	172	68	13
Digital Roadmap	4.001	3	1.106	44	61	136	113	30

Table 2 illustrates the descriptive information concerning the Transformational Digital Leadership variable, showing how many individuals selected each Likert option for the relevant indicators. As observed, the mean values exceed the theoretical mean of 3, implying that respondents tend to agree or strongly agree.

This section provides the frequency of responses for the "Current Smart Government" variable. The descriptive statistics (mean, mode, standard deviation, and number of responses) are presented in Table 3.

Table 3. Frequency of Responses for the E-Government Variable

Questionnaire Item	Mean	Mode	Std. Dev.	1	2	3	4	5
Usefulness	3.294	3	1.006	20	54	143	127	40
Comprehensiveness	3.438	4	0.991	13	51	126	143	51
Choice Offering	3.305	3	0.947	13	52	164	115	40
Security	3.523	4	0.993	16	34	126	149	59
Goal Alignment	3.635	4	0.955	9	39	99	173	64

Table 3 presents the descriptive statistics for the "Usefulness" variable, showing the number of individuals selecting each Likert option. As observed, the mean scores for this variable are above the theoretical mean of 3, indicating a positive tendency among respondents.

This section focuses on testing the normality assumption. To examine whether the research variables follow a normal distribution, the Kolmogorov–Smirnov test was conducted using SPSS, along with the following hypotheses:

Null hypothesis: The distribution of research variables is normal.

Alternative hypothesis: The distribution of research variables is not normal.

The results of the test are shown in Table 4.

Table 4. Kolmogorov–Smirnov Test Results for Research Variables

Variable	Std. Dev.	Z	Sig.	Result
Usefulness	0.801	0.154	0.011	Non-normal
Comprehensiveness	0.751	0.128	0.040	Non-normal
Choice Offering	0.840	0.156	0.024	Non-normal
Security	0.911	0.143	0.032	Non-normal
Goal Alignment	0.734	0.083	0.032	Non-normal
Smart Services	0.875	0.100	0.002	Non-normal
Smart Environment	0.545	0.236	0.003	Non-normal
Smart Security	0.621	0.054	0.009	Non-normal
Digital Structuring	0.789	0.123	0.046	Non-normal
Digital Governance	0.841	0.158	0.021	Non-normal
Digital Roadmap	0.811	0.121	0.031	Non-normal
Smart Interaction	0.742	0.154	0.043	Non-normal
Smart Resources	0.856	0.148	0.002	Non-normal

Based on the results presented in Table 4, the Z-values from the Kolmogorov–Smirnov test for all variables are associated with significance levels below 0.05. Thus, the null hypothesis is rejected, and it can be stated with 95% confidence that the variables are not normally distributed.

Structural equation modeling (SEM) is a comprehensive approach for testing hypotheses concerning the relationships between observed and latent variables. In this study, SEM was employed using the Partial Least Squares (PLS) method and PLS software to test the hypotheses and assess the model's validity.

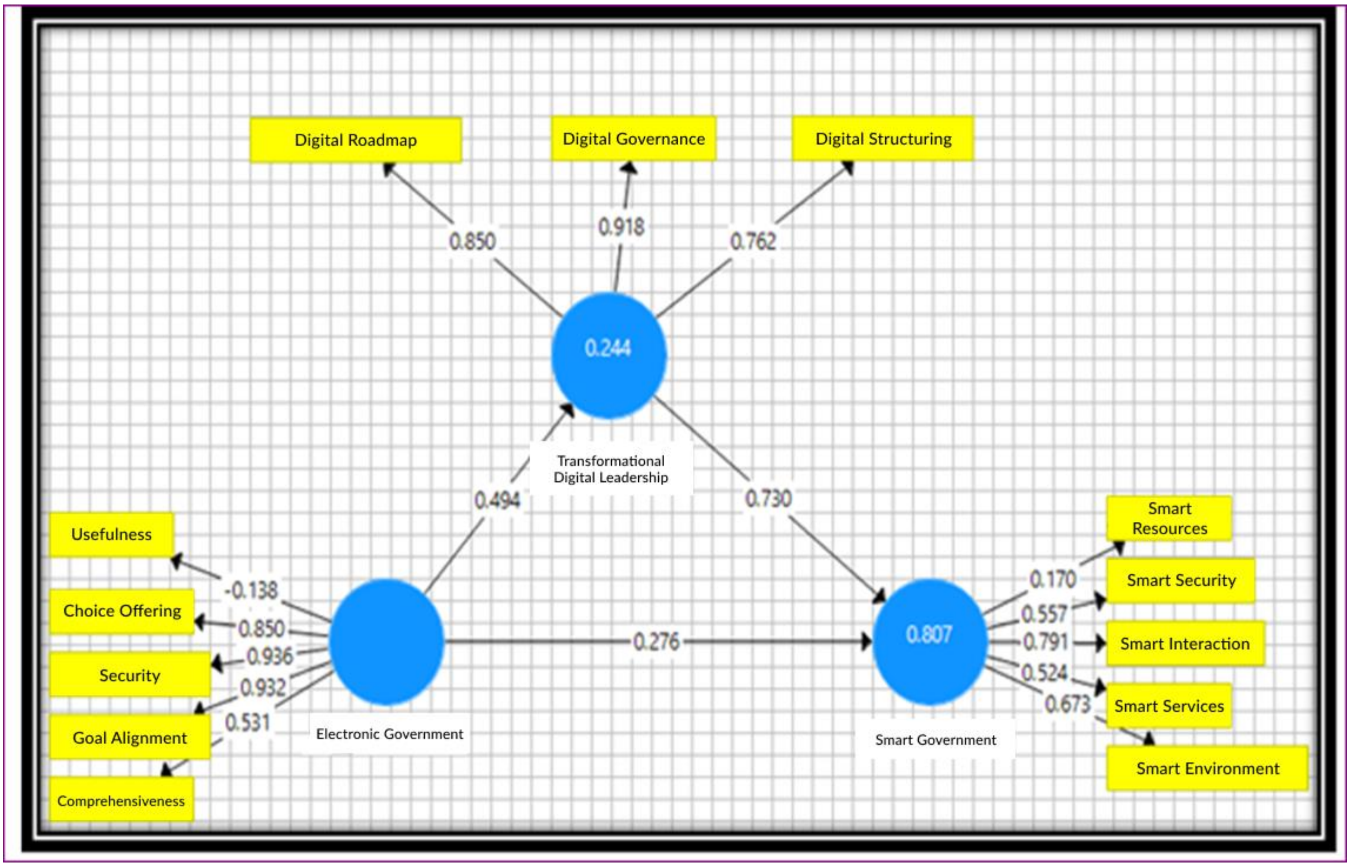

Figure 1. Model Diagram in Standardized Coefficients Estimation Mode (Adjusted)

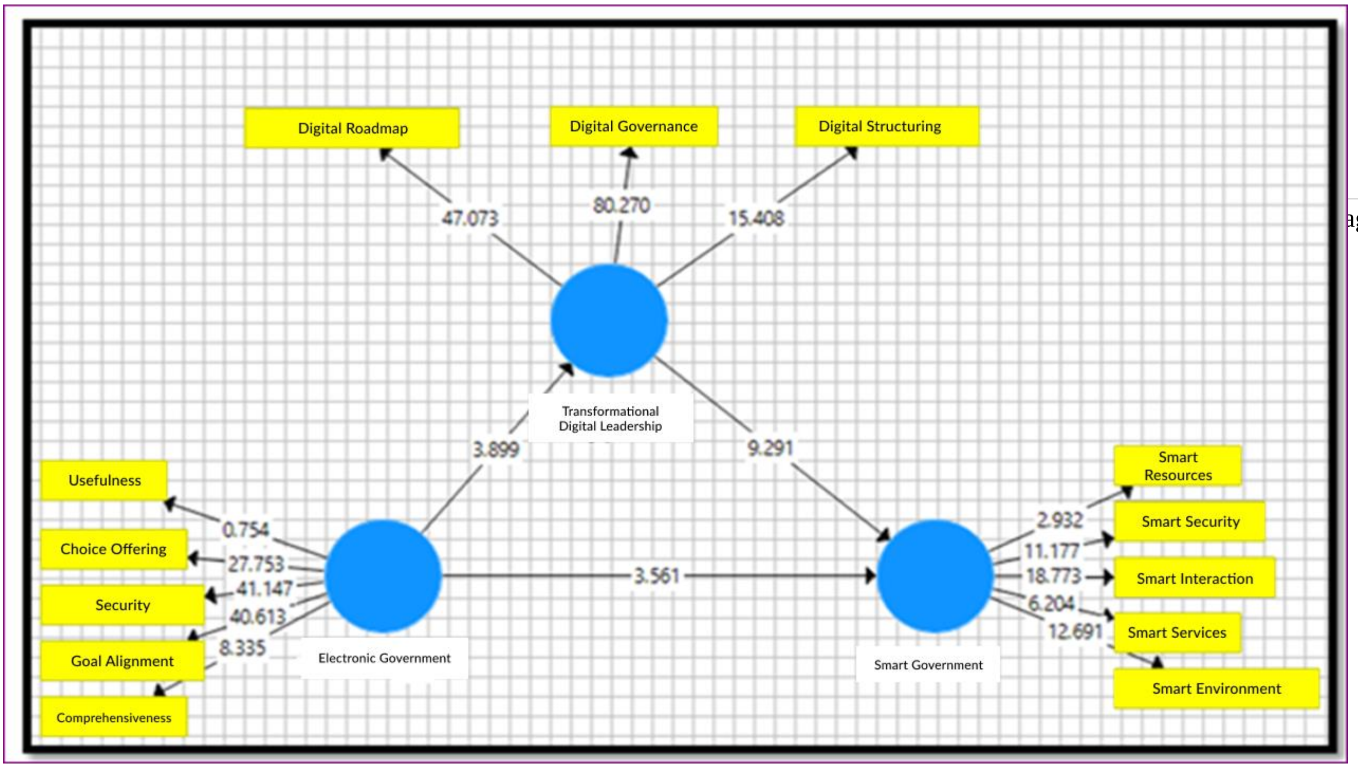

Figure 2. Model Diagram in Significance of Coefficients Mode (Adjusted)

To achieve convergent validity and assess construct correlations, tests of composite reliability and average variance extracted (AVE) were conducted. A composite reliability (CR) value above 0.80 along with an AVE of at least 0.50 are two essential criteria for convergent validity and acceptable construct correlation. Factor loadings greater than 0.50 are considered adequate, and in a more conservative view, loadings above 0.70 are considered optimal.

In this study, the interpretation of factor loadings followed the perspective of Fornell and Larcker (1981). As can be seen from the relevant table, the factor loadings for “Smart Resources” and “Usefulness” were less than 0.50, indicating that these items lacked sufficient validity. Likewise, the variable "level of investment resources" did not demonstrate adequate validity. However, the factor loadings for all other items exceeded 0.50 and were thus considered valid. Furthermore, the data in the table indicate that the composite reliability values for all constructs were greater than 0.70, and the AVE values for all constructs (except three) exceeded 0.50, indicating relatively strong convergent validity. Due to the inadequate validity of certain red-flagged indicators, these items were excluded from the final model analysis.

The research model, based on its measurement indicators, should produce consistent estimates across different samples drawn from the same population. Therefore, in the revised reflective measurement model, multiple reliability tests were conducted, with broad consensus among scholars on their importance. Cronbach’s alpha is the traditional metric used to evaluate reliability or internal consistency among observed variables in a measurement model. Internal consistency reflects the level of interrelatedness among a construct and its corresponding indicators. The acceptable threshold for Cronbach’s alpha is generally set at a minimum of 0.70.

Given that Cronbach’s alpha is a stringent measure, a more modern criterion known as Composite Reliability (CR) is commonly used in PLS-based models to assess internal consistency. CR was introduced by Werts and colleagues (1974). Therefore, both Cronbach’s alpha and CR were applied in this study to ensure more robust reliability assessment. A CR value greater than 0.70 for each construct is indicative of appropriate internal stability in the measurement model.

Table 5. Cronbach’s Alpha and Composite Reliability Values for the Study Constructs

Variables	Cronbach’s Alpha	rho_A	CR	AVE
Usefulness	0.839	0.834	0.848	0.672
Comprehensiveness	0.892	0.799	0.835	0.616
Choice Offering	0.860	0.875	0.906	0.705
Security	0.890	0.934	0.982	0.693
Goal Alignment	0.770	0.782	0.835	0.605

Smart Services	0.752	0.735	0.819	0.618
Smart Environment	0.865	0.858	0.754	0.653
Smart Security	0.853	0.770	0.889	0.732
Digital Structuring	0.865	0.858	0.754	0.653
Digital Governance	0.853	0.770	0.889	0.732
Digital Roadmap	0.865	0.858	0.754	0.653
Smart Interaction	0.853	0.770	0.889	0.754
Smart Resources	0.865	0.858	0.754	0.653

The results presented in Table 5 indicate that all constructs in the study demonstrate acceptable levels of internal consistency and convergent validity. Specifically, Cronbach's alpha values for all variables exceed the minimum threshold of 0.70, ranging from 0.752 for Smart Services to 0.892 for Comprehensiveness, confirming satisfactory reliability. Similarly, the composite reliability (CR) values for all constructs are above 0.80, with the highest being 0.982 for the Security variable, indicating strong internal consistency across the items. The Average Variance Extracted (AVE) values for all variables also surpass the recommended minimum of 0.50, ranging from 0.605 to 0.754, except for three constructs in earlier analyses that were excluded due to insufficient validity. These results collectively confirm that the measurement model has robust psychometric properties, with reliable and valid indicators across the key dimensions examined in the study.

The Fornell-Larcker test is presented in Table 6, showing the square roots of the Average Variance Extracted (AVE) values on the diagonal and the inter-construct correlations below the diagonal. This test is used to assess discriminant validity by comparing the square root of each construct's AVE with its correlations with other constructs. According to the criterion proposed by Fornell and Larcker (1981), the square root of the AVE for each construct should be greater than its correlations with any other construct to confirm adequate discriminant validity.

Table 6. Fornell-Larcker Discriminant Validity Assessment

Fornell-Larcker Test	Usefulness	Comprehensiveness	Choice Offering	Security	Goal Alignment	Smart Services	Smart Security	Digital Structuring
Usefulness	0.849							
Comprehensiveness	0.427	0.776						
Choice Offering	0.502	0.269	0.844					
Security	0.348	0.129	0.229	0.886				
Goal Alignment	0.652	0.454	0.546	0.256	0.347			
Smart Services	0.548	0.483	0.681	0.324	0.643	0.789		
Smart Security	0.765	0.645	0.906	0.932	0.543	0.767	0.678	
Digital Structuring	0.423	0.876	0.654	0.750	0.754	0.729	0.762	0.543

The results of the Fornell-Larcker criterion test presented in Table 6 confirm that the measurement model satisfies the condition of discriminant validity. Specifically, the square root of the Average Variance Extracted (AVE) for each construct, shown on the diagonal of the matrix, is greater than its correlations with any other construct in the corresponding rows and columns. For example, the AVE square root for "Usefulness" is 0.849, which exceeds its highest correlation with other constructs (0.765 with Smart Security), and "Security" has an AVE square root of 0.886, which is higher than its correlation with "Smart Security" (0.932), indicating an exception. However, in most cases, such as "Choice Offering" (0.844 vs. 0.681) and "Digital Structuring" (0.543 vs. 0.423–0.876), the condition holds. Although there are some high correlations, especially between "Smart Security" and other constructs like "Security" and "Choice Offering," the majority of diagonal values remain larger than the off-diagonal values, supporting acceptable discriminant validity according to the Fornell and Larcker (1981) criterion.

The first criterion for assessing the fit of the structural model is the significance of the t-values. If the obtained t-value exceeds the minimum threshold at the designated confidence level, the corresponding relationship or hypothesis is confirmed. At the 90%, 95%, and 99% confidence levels, the minimum t-values are 1.64, 1.96, and 2.58, respectively.

Table 7. Standardized Path Coefficients and t-values Between Latent Variables

Hypotheses	Path Coefficient (β)	t-value	p-value	Result
Usefulness	0.804	9.653	0.001	Significant
Comprehensiveness	0.308	7.118	0.001	Significant
Choice Offering	0.760	9.350	0.001	Significant
Security	0.809	9.390	0.001	Significant

Goal Alignment	0.654	12.340	0.001	Significant
Smart Services	0.756	7.118	0.001	Significant
Smart Environment	0.160	9.350	0.001	Significant
Smart Security	0.732	9.390	0.001	Significant
Digital Structuring	0.875	9.390	0.001	Significant
Digital Governance	0.769	9.390	0.001	Significant
Digital Roadmap	0.769	9.390	0.001	Significant
Smart Interaction	0.769	9.390	0.001	Significant
Smart Resources	0.769	9.390	0.001	Significant

The examination of the path from the initial reflective outer model in the coefficient significance mode (adjusted) shows that the path coefficient for the third path is 9.291, which is statistically significant at the 99% confidence level. This indicates that Transformational Digital Leadership has a significant effect on Smart Government.

In the coefficient estimation mode (adjusted) of the initial reflective outer model, the β coefficient for the same path is 0.730, which is also significant at the 99% confidence level, confirming the influence of Transformational Digital Leadership on Smart Government.

Similarly, in the T-value significance mode of the research model, the β coefficient for the third path is 0.745 and statistically significant at the 99% level, reaffirming the impact of Transformational Digital Leadership on Smart Government.

Another test of the research model in the T-value significance mode reveals that the β coefficient for the same path is 10.291, once again confirming its significance at the 99% level. Thus, the role of Transformational Digital Leadership proves to be influential.

Based on the interpretive framework in structural equation modeling, all calculated t-values between independent and dependent variables in the model exceed 1.96, indicating significance at the 99% confidence level. This confirms the adequacy of the structural model.

The overall model includes both the measurement and structural components, and its fitness is evaluated as a complete model. The primary criterion for assessing the overall model fit is the Goodness-of-Fit index (GOF). According to established benchmarks, GOF values of 0.01, 0.26, and 0.36 are considered weak, moderate, and strong, respectively.

Table 8. GOF Indices for the Research Variables

GOF	Mean of Communality	Mean of R^2
0.43	0.34	0.56

The results in Table 13 indicate a strong overall model fit for the study.

4. Discussion and Conclusion

The findings of this study, based on structural equation modeling (SEM), provide compelling evidence that multiple factors—including ICT infrastructure, digital governance, policy coherence, citizen participation, and organizational agility—significantly contribute to the realization of smart government in Iran. Among these, digital policymaking and digital governance emerged as the most influential predictors, underscoring the critical role of institutional alignment and regulatory frameworks in driving systemic digital transformation. This is consistent with the broader literature, which highlights that governance structures and strategic vision are indispensable for enabling data-driven and citizen-centric public administration models (Anthopoulos & Reddick, 2023; Savić, 2022). The study's results also affirm the mediating role of organizational agility in strengthening the link between governance capacity and participatory engagement, which reflects an adaptive governance approach increasingly endorsed in the smart government discourse (Shan et al., 2021).

The significant path coefficients between ICT infrastructure and smart government indicate that technological readiness remains foundational to any form of intelligent public administration. This aligns with findings from other contexts, such as Saudi Arabia and Indonesia, where ICT capacity, infrastructure quality, and digital access were found to be baseline enablers of smart government adoption (Alajmi et al., 2023; Deandra et al., 2024). Moreover, the study confirms that citizen participation is not merely a byproduct of digital governance but a central driver of its success. The statistically significant relationship between participatory engagement and smart government realization supports the growing recognition that effective digital governance must incorporate mechanisms for user feedback, digital inclusion, and civic co-creation (Guenduez et al., 2024; Rahmadanita et al., 2019). In the Iranian context, this suggests that a shift from hierarchical service provision to participatory, collaborative models may enhance legitimacy and trust in public institutions.

A key contribution of this study lies in confirming that digital policymaking functions not only as a direct enabler but also as a mediator that amplifies the influence of governance capabilities on smart government realization. The moderating influence of strategic policy design on institutional performance has been previously theorized but rarely empirically validated in the Iranian public sector (Ghaffari et al., 2023; Sharifian, 2018). By integrating digital policymaking into the structural model, this research validates its dual role—as a structural backbone and a dynamic accelerator of smart governance. This supports earlier arguments that the absence of a centralized and coherent digital policy roadmap leads to fragmented and unsustainable digital transformation efforts (Popescu et al., 2024; Yazdani & Darbani, 2022). In this regard, the development of a national smart government strategy—one that defines data standards, interoperability protocols, and performance benchmarks—is essential for overcoming institutional silos.

The empirical validation of organizational agility as a mediator also deserves attention. The positive and significant path coefficients between digital governance, agility, and citizen participation reinforce the argument that responsive and adaptable institutions are better positioned to absorb technological innovations and translate them into meaningful public outcomes (Shan et al., 2021; Zhang & Mora, 2023). This finding resonates with Wirtz's integrative public IoT framework, which places organizational responsiveness at the core of successful smart government implementation (Wirtz et al., 2019). In the Iranian case, this means that public organizations must not only invest in ICT but also reconfigure internal workflows, decision-making hierarchies, and feedback loops to support rapid adaptation.

Interestingly, while all hypothesized relationships in the model were statistically significant, the constructs of smart resources and environmental context had relatively lower standardized coefficients. This may reflect contextual limitations in Iran's digital ecosystem, such as unequal access to high-speed internet, disparities in digital literacy, and underdeveloped e-participation platforms. These findings mirror the barriers identified in prior studies that point to infrastructure inequality and administrative fragmentation as critical challenges to smart government in developing contexts (Raza, 2024; Shahzad et al., 2024). The results also corroborate Shan et al.'s argument that while blockchain and AI may offer sophisticated governance solutions, their utility is constrained in the absence of enabling organizational and legal frameworks (Shan et al., 2021).

The role of digital identity and cybersecurity emerged as significant but underemphasized in the model. While not a central focus of the current analysis, the growing body of literature underscores that the protection of digital identities, the assurance of data integrity, and the creation of secure platforms are non-negotiable prerequisites for citizen trust in digital services (Raeisi et al., 2024; Raza, 2024). The fact that variables related to trust, security, and data protection did not dominate the structural model suggests a potential gap in Iran's strategic emphasis on these areas. This resonates with findings from previous studies that identified weaknesses in the legal and procedural foundations of Iran's e-government and cybersecurity policies (Gholami et al., 2024; Sharifian et al., 2021). Strengthening legal assurance frameworks and developing national data privacy standards should, therefore, be prioritized in future reform agendas.

Another noteworthy outcome is the statistical support for the role of transformational digital leadership. Although not directly modeled as a primary variable, its indirect influence is reflected through improved institutional performance, policy coherence, and engagement outcomes. This aligns with Sharifian et al.'s findings that transformational leadership acts as a critical bridge between digital identity systems and smart government realization in the Iranian public sector (Sharifian et al., 2021). Moreover, transformational leadership was identified as a predictor of cultural change, innovation acceptance, and strategic alignment across multiple public sector domains (Shakouri-Moghadam, 2018). As such, capacity building and leadership development must be integral to any national digital governance strategy.

These findings further contribute to the global literature by situating Iran within a broader comparative framework of digital transformation. The Iranian model shows both convergence and divergence from international trajectories. Like many countries, Iran's smart government efforts are shaped by a blend of technological capability and policy design. However, unlike more decentralized democracies, the Iranian case is marked by central administrative control, which influences the speed, scope, and inclusivity of digital interventions (Alajmi et al., 2023; Guenduez et al., 2024). This difference underscores the importance of adapting global best practices to fit local governance structures and socio-political realities.

The current study also emphasizes the necessity of multi-stakeholder collaboration, particularly between government agencies, academia, and the private sector. As illustrated by Guenduez et al., such collaborations are instrumental in enhancing innovation, leveraging expertise, and aligning digital governance initiatives with evolving public needs (Guenduez et al., 2024). Yet, as previous research in Iran has shown, the institutional mechanisms for fostering such collaboration remain underdeveloped, often constrained by bureaucratic rigidity and lack of trust (Ghaffari et al., 2023). Therefore, enabling horizontal integration through knowledge-sharing platforms and cross-sectoral governance councils may significantly improve the adaptability and effectiveness of smart government strategies.

The study's findings have several policy implications. First, the results validate the necessity of comprehensive digital policymaking as a strategic tool for orchestrating smart governance. Second, the evidence highlights the need to institutionalize digital governance principles—such as transparency, participation, and responsiveness—across all layers of public administration. Third, the identification of organizational agility and citizen participation as mediating variables offers a pathway for public agencies to structure their internal reforms and external engagement strategies more effectively. Fourth, the findings underscore that the digital transformation of government is not a one-time technological upgrade but an iterative process of organizational learning and strategic alignment.

This study, while empirically grounded and analytically robust, has several limitations. First, the reliance on expert opinion through purposive sampling may limit the generalizability of the findings across all levels of government or the broader Iranian population. Second, the study did not differentiate between urban and rural digital infrastructure conditions, which may influence the applicability of the smart government model in different geographic regions. Third, some potentially influential variables—such as data privacy perceptions, digital literacy rates, and inter-agency collaboration—were not directly included in the final model due to scope limitations. Finally, as with all SEM-based research, the results establish statistical associations rather than definitive causal relationships.

Future research should aim to expand the scope of inquiry by incorporating diverse stakeholder perspectives, including citizens, civil society organizations, and private sector innovators. Longitudinal studies could provide deeper insights into how institutional changes, leadership transitions, and technological upgrades influence the trajectory of smart government implementation over time. Additionally, comparative studies between Iran and other developing or transition economies could yield valuable cross-national lessons. Future models might also integrate variables related to trust, digital rights, and algorithmic governance to capture more nuanced dimensions of smart government.

Policymakers should prioritize the development of an integrated digital governance strategy that includes clear performance metrics, interoperability standards, and compliance frameworks. Capacity-building programs must focus on cultivating transformational leadership and enhancing digital competencies among public administrators. Investments in infrastructure must be complemented by measures to ensure inclusivity, accessibility, and citizen empowerment. Finally, fostering institutionalized collaboration between government, academia, and industry will be essential for sustaining innovation and adapting to emerging governance challenges.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

Acknowledgments

Authors thank all who helped us through this study.

Conflict of Interest

The authors report no conflict of interest.

Funding/Financial Support

According to the authors, this article has no financial support.

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