

Citation: Khajehbafghi, R., Asghari, H., & Daneshfard, K. (2027). Designing and Validating a Comprehensive Model for the Implementation of Smart Governance Based on Administrative Smartization: A Qualitative Approach. *Digital Transformation and Administration Innovation*, 5(1), 1-15.

Received date: 2026-05-14 Revised date: 2026-08-24 Accepted date: 2026-08-31 Initial Published date: 2026-09-06 Published date: 2027-01-01



Designing and Validating a Comprehensive Model for the Implementation of Smart Governance Based on Administrative Smartization: A Qualitative Approach

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Abstract

Reforming and enhancing the efficiency of the national administrative system requires a transition from traditional and purely technology-oriented approaches toward the implementation of integrated models of smart governance. Accordingly, the present study aimed to identify, design, and validate a comprehensive model for implementing smart governance based on administrative smartization in Iranian public-sector organizations. In terms of purpose, this research was applied, and in terms of nature, it was a qualitative study employing an exploratory–explanatory approach. The study population consisted of experts and senior and middle managers in the fields of governance, public administration, information technology, and digital transformation, with a particular focus on the Ministry of Petroleum and its affiliated units. Criterion-based purposive sampling was conducted until theoretical saturation was achieved. Data were collected through document analysis and semi-structured interviews. Data analysis was conducted based on Braun and Clarke’s six-phase thematic analysis framework, and fuzzy pairwise comparisons were subsequently employed to examine the validity and prioritize the dimensions and components. Analysis of the qualitative data resulted in the extraction of 60 basic indicators, 20 organizing themes, and five overarching themes (main dimensions). The five dimensions of the final model were: “data governance and intelligent decision-making,” “smartization infrastructure and technologies,” “managerial and institutional requirements of smart governance,” “human capital and smartization culture,” and “participation, transparency, and public value creation.” The results of fuzzy pairwise comparisons also confirmed the conceptual and empirical validity of the model and indicated that the successful implementation of smart governance requires the simultaneous synergy of these dimensions. The implementation of smart governance in executive agencies is a multidimensional phenomenon, and reducing it to the procurement of technological equipment or the fragmented development of isolated systems would be ineffective. The developed indigenous model provides an integrated and practical framework for policymakers and public managers to enhance transparency, improve the quality of public services, and increase the efficiency of the national administrative system through data-driven decision-making, regulatory reform, human-capital empowerment, and public participation.

Keywords: smart governance, administrative smartization, digital transformation, thematic analysis, data-driven decision-making, administrative system.



1. Introduction

The accelerating diffusion of digital technologies across public institutions has fundamentally transformed the conceptual and operational foundations of public administration. Governments are increasingly expected to move beyond conventional electronic government models, which primarily focus on digitizing existing processes, toward more integrated forms of smart governance in which data, digital infrastructure, artificial intelligence, institutional coordination, managerial capabilities, and citizen participation are systematically combined to improve public-sector decision-making and service delivery. Smart governance therefore represents more than the adoption of advanced technologies; it involves the redesign of administrative structures, decision processes, accountability mechanisms, interorganizational relationships, and patterns of interaction between government and society. In this context, administrative smartization has emerged as a strategic pathway through which public organizations can increase responsiveness, transparency, efficiency, adaptability, and public value while simultaneously reducing procedural complexity and improving the quality of governmental decisions (Nasrulhaq, 2025; Sulistiyo, 2024; Taghvaei & Rahimi, 2024).

The development of smart governance is closely associated with the broader process of digital transformation in government. Unlike earlier approaches to administrative automation, digital transformation is not limited to replacing paper-based procedures with electronic systems. Rather, it involves a comprehensive reconfiguration of organizational processes, institutional arrangements, service-delivery mechanisms, managerial practices, and decision-making architectures. Within this transformation, smart governance reflects the ability of public institutions to exploit digital technologies in an integrated and strategic manner while maintaining organizational coherence, regulatory legitimacy, accountability, and responsiveness to societal needs. In this regard, the convergence of management, law, and public policy has become increasingly important because technological modernization without corresponding institutional and regulatory reforms may generate fragmented systems, legal ambiguities, organizational resistance, and ineffective implementation (Taghvaei & Rahimi, 2024; Zanoobi et al., 2024). Consequently, the transition toward smart governance should be understood as an institutional transformation rather than as a purely technological modernization initiative.

One of the most fundamental pillars of smart governance is the systematic governance of data. Contemporary public organizations produce and process enormous volumes of administrative, financial, operational, social, and service-related data. However, the existence of data alone does not necessarily lead to better governance. The strategic value of data depends on the establishment of appropriate mechanisms for data integration, standardization, quality assurance, access control, interoperability, security, and institutional accountability. Data governance provides the organizational and managerial architecture required to define who owns data, who can access and modify them, how data are standardized and shared, and how their quality, security, and ethical use are maintained. Research on smart government organizations has therefore increasingly emphasized data governance as a core component of intelligent public administration, particularly because fragmented databases and inconsistent information-management practices can substantially undermine data-driven decision-making (Kamaneh et al., 2026). A coherent data-governance architecture is thus essential for transforming dispersed administrative information into a strategic public-sector resource.

The importance of data governance becomes even greater as governments increasingly adopt data-driven approaches to policymaking and management. Data-driven governance involves the systematic use of empirical information, analytical tools, and real-time or near-real-time evidence to formulate policies, allocate resources, monitor performance, anticipate risks, and evaluate public programs. Big data analytics can provide managers with the capacity to identify behavioral patterns, detect emerging problems, model future scenarios, and improve policy precision. In urban and administrative management, the use of large-scale datasets has increasingly been associated with more informed decision-making and a shift from intuition-based administration toward evidence-based and technology-supported policymaking (Emamipannah, 2025). Similarly, data-oriented approaches can improve the performance of intelligence and security organizations by strengthening situational awareness, organizational learning, analytical capability, and the capacity to respond rapidly to complex environmental changes (Tiznaz et al., 2024). Accordingly, data governance and intelligent analytics form mutually reinforcing components of a broader smart-governance system.



Artificial intelligence constitutes another central element in the evolution of smart governance. AI-based systems can enhance governmental capacities in areas such as predictive analytics, automated classification, anomaly detection, decision support, resource optimization, citizen-service personalization, and policy simulation. The use of artificial intelligence in public services can improve both the speed and accuracy of administrative decisions, particularly when large volumes of heterogeneous information must be processed. Nevertheless, AI-enabled governance also introduces concerns related to algorithmic transparency, privacy, cybersecurity, discrimination, accountability, explainability, and the allocation of responsibility for automated decisions. Research on data-driven artificial intelligence governance in public services has highlighted the simultaneous existence of substantial opportunities and complex governance challenges, demonstrating that technological capacity must be accompanied by regulatory, ethical, and institutional safeguards (Zafari & Pour, 2024). Similarly, the integration of AI into smart policing illustrates how intelligent systems can strengthen prediction and operational coordination while simultaneously creating risks that must be addressed through appropriate risk-governance mechanisms (Pei, 2025).

The technological infrastructure supporting smart governance extends beyond artificial intelligence. High-capacity communication networks, secure internet connectivity, cloud computing, interoperable information systems, digital platforms, blockchain technologies, Internet of Things applications, and integrated databases collectively constitute the technological ecosystem of administrative smartization. These technologies create the technical conditions for real-time information exchange, automated service provision, interagency coordination, and intelligent decision support. For example, blockchain technology has been examined as a mechanism for improving citizen engagement by increasing transparency, traceability, trust, and the reliability of digital transactions within governance systems (Testi et al., 2025). In specialized sectors, smart technologies also facilitate the construction of advanced governance architectures. Research on smart-grid governance, for instance, shows that technological innovation generates new legal and institutional requirements concerning ownership, exchange mechanisms, accountability, and regulatory design (Gholampour & Esfandiari, 2025). These developments indicate that smart governance depends on the alignment of technological innovation with institutional design rather than on technology adoption in isolation.

Another important characteristic of smart governance is its potential to improve transparency and accountability. Digital platforms, open-data systems, electronic monitoring, traceable administrative processes, and integrated information systems can reduce information asymmetries between public institutions and citizens and strengthen the capacity of stakeholders to evaluate governmental performance. Transparency can also contribute to corruption prevention by making administrative transactions and decision procedures more visible and auditable. Studies of smart-city and e-government initiatives have shown that digitally enabled public-service systems can improve transparency and accountability when they are accompanied by clear institutional rules, reliable information systems, and citizen-oriented service mechanisms (Margareta et al., 2025). The relationship between smart governance and fiscal administration is also noteworthy, as intelligent information systems, data integration, and digital monitoring can strengthen taxation systems and support efforts to control tax evasion (Ashrafi, 2025). Therefore, administrative smartization may contribute not only to operational efficiency but also to the integrity and legitimacy of public administration.

Citizen participation is equally central to the conceptualization of smart governance. Traditional bureaucratic governance has often been characterized by hierarchical decision-making and limited opportunities for direct interaction between citizens and public organizations. Smart governance, by contrast, increasingly emphasizes collaborative, participatory, and network-based forms of public decision-making. Digital participation mechanisms can enable citizens to express preferences, provide feedback, participate in policy discussions, monitor service quality, and contribute to public problem-solving. Research on online political participation in smart cities suggests that digital environments can expand opportunities for civic involvement, although the effectiveness of participation depends on institutional openness, platform accessibility, citizens' digital capabilities, and the degree to which participation influences actual decision-making processes (Vaz, 2024). Blockchain and other decentralized technologies have also been explored as tools for strengthening citizen engagement by creating secure and transparent mechanisms for participation and information exchange (Testi et al., 2025). Hence, smart governance requires not

merely digitally connected citizens but meaningful institutional mechanisms through which participation can contribute to governance outcomes.

The growing emphasis on participation is closely linked to the concept of public value. The effectiveness of smart governance should ultimately be evaluated not by the number of digital platforms or intelligent systems deployed, but by the extent to which these systems improve outcomes for citizens and society. Public value may be reflected in greater service accessibility, higher service quality, improved responsiveness, enhanced trust, stronger accountability, greater social inclusion, and more effective use of public resources. Studies of smart urban management have demonstrated that the integration of technology, governance capacity, and institutional coordination can contribute to improved good-governance outcomes by strengthening responsiveness, transparency, participation, and service effectiveness (Vakilian et al., 2024). Similarly, research on the dimensions of smart governance in public service delivery indicates that smart governance is most effective when technological capacities are aligned with citizen needs, organizational capabilities, and public-service objectives (Sulistiyo, 2024). These findings reinforce the view that smart governance should be treated as a public-value-oriented administrative paradigm rather than as a technology deployment strategy.

The significance of smart governance is also evident in sector-specific applications. Smart tourism governance, for example, requires coordination among institutions, technology providers, local authorities, communities, and private-sector actors to simultaneously advance innovation, resilience, sustainability, and service quality. From an institutional perspective, smart governance can support tourism destinations by integrating information systems with collaborative governance arrangements and adaptive policy frameworks (Abdelmalak, 2025). Likewise, intelligent tourism systems demonstrate how technology-supported governance can influence the selection and management of smart destinations by integrating digital information, service personalization, and intelligent decision-support capabilities (Naveen Kumar et al., 2025). These sectoral examples demonstrate that smart governance is inherently multidimensional and must integrate technological, organizational, institutional, and stakeholder-related capacities.

Education represents another domain in which integrated smart-governance frameworks have begun to emerge. The application of artificial intelligence, blockchain, and data-driven management systems in educational governance illustrates the potential value of combining multiple digital technologies within a unified governance architecture. Such hybrid approaches can support more efficient administration, secure information exchange, evidence-based decision-making, institutional transparency, and personalized service provision (Gurram et al., 2025). The significance of these models for public administration lies in demonstrating that isolated technological solutions often provide limited value unless they are integrated into a coherent system of data management, decision support, organizational processes, and institutional governance. This insight is particularly relevant to large public-sector organizations, where fragmented technologies and independent databases frequently constitute major barriers to administrative integration.

Despite the substantial potential of technology, successful smart governance remains fundamentally dependent on managerial and institutional capabilities. Senior-management commitment, strategic leadership, organizational coordination, regulatory alignment, change management, and clearly defined governance structures determine whether technological investments are transformed into sustainable administrative capabilities. Empirical research on smart government in Iran has identified multiple dimensions affecting its realization, particularly those associated with digital governance, institutional conditions, administrative processes, and technological readiness (Fathi et al., 2025). Likewise, research on organizations undergoing digital transformation has indicated that contextual, organizational, technological, and managerial factors jointly shape the development of smart-governance capabilities (Zanoubi et al., 2024). These findings suggest that the absence of managerial commitment or institutional coordination can neutralize even advanced technological investments.

Interorganizational integration constitutes a particularly important challenge in public-sector smartization. Government organizations are generally embedded in complex administrative networks involving multiple ministries, agencies, regulatory bodies, public enterprises, and service providers. Each may operate different databases, technological standards, legal mandates, and administrative procedures. The coexistence of incompatible systems and overlapping institutional responsibilities can restrict data sharing, delay decision-making, and undermine integrated service provision. Smart governance therefore requires mechanisms for horizontal coordination, interoperability, shared data standards, institutional role clarification, and unified strategic direction. Experiences with smart governance in metropolitan settings indicate that



institutional coordination and the capacity to integrate governmental actors are critical determinants of successful implementation (Nasrulhaq, 2025). Accordingly, smart governance should be designed as an ecosystem in which administrative units, technologies, data resources, and institutional actors operate through coordinated rather than fragmented arrangements.

Human capital represents another indispensable component of smart governance. Advanced digital systems cannot generate sustainable organizational value unless public-sector employees possess the knowledge, competencies, digital literacy, and adaptive capacity required to use them effectively. Administrative smartization therefore requires systematic investment in human-resource development, specialized digital training, competency development, organizational learning, and the cultivation of an innovation-oriented workforce. This requirement becomes particularly significant in complex public organizations where employees must interact with intelligent systems, interpret analytical outputs, manage digital processes, and adapt to changing technological conditions. Research on smart human resource governance in the Iranian public sector, particularly within the National Iranian Oil Company, has emphasized the importance of integrating human-resource governance with technological and organizational smartization processes (Mirzaei et al., 2025). Such findings underscore that smart governance is as much a human and managerial transformation as it is a technological one.

The organizational culture surrounding technology also affects the effectiveness of administrative smartization. Employees may resist digital systems if they perceive technological change as threatening, overly complex, inconsistent with established routines, or inadequately supported by management. Consequently, organizational readiness for smart governance depends on promoting a data-driven culture, encouraging organizational learning, communicating the benefits of smartization, and developing confidence in the use of emerging technologies. Digital literacy must also extend beyond employees to citizens, because unequal access to digital technologies and differences in technological competencies can create a digital divide that limits the inclusiveness of smart public services. The institutional legitimacy of smart governance therefore depends on balancing technological sophistication with accessibility, usability, fairness, and social inclusion. In this respect, research emphasizing integrated models of smart public management has reinforced the importance of combining technological innovation with governance quality and user-oriented administrative mechanisms (Fathi et al., 2025; Vakilian et al., 2024).

Legal and regulatory frameworks also play a decisive role in determining whether smart governance can be institutionalized. Administrative legislation developed for conventional bureaucratic settings may not adequately address issues such as automated decision-making, data exchange, algorithmic accountability, digital identity, cybersecurity, privacy, platform governance, or the ownership and use of large-scale datasets. The emergence of smart governance therefore requires legal adaptation alongside technological innovation. Studies examining the convergence of law, politics, and management in governmental digital transformation emphasize that smart governance must be supported by coherent legal frameworks capable of regulating both technological opportunities and associated risks (Taghvaei & Rahimi, 2024). Similar concerns are visible in specialized areas such as smart-grid governance, where technological developments require new legal architectures for regulating digital transactions, ownership structures, and institutional responsibilities (Gholampour & Esfandiari, 2025). Therefore, legal modernization constitutes an integral part of administrative smartization rather than an external regulatory concern.

Security, privacy, and risk management are similarly indispensable. As public organizations become increasingly dependent on interconnected databases, cloud services, intelligent algorithms, sensors, and digital platforms, exposure to cyber risks and unauthorized access increases. The concentration of sensitive citizen and organizational information in integrated environments may create substantial vulnerabilities if information-security governance is weak. Moreover, public trust may decline if citizens perceive that data are being collected, processed, or shared without sufficient safeguards. AI applications intensify these concerns because algorithmic systems can create new forms of opacity and accountability risk (Pei, 2025; Zafari & Pour, 2024). Accordingly, cybersecurity, data protection, privacy, ethical governance, and risk management should be incorporated into the architecture of smart governance from the design stage rather than being treated as subsequent technical controls.

The Iranian public sector provides a particularly relevant setting for investigating these issues. Iran has increasingly emphasized digital transformation, electronic services, intelligent administrative systems, and data-based government; nevertheless, the institutionalization of smart governance continues to face challenges associated with fragmented information systems, insufficient interoperability, administrative complexity, regulatory gaps, uneven digital capabilities, organizational



resistance, and weak interagency coordination. Existing Iranian studies have examined specific dimensions of the phenomenon, including digital governance and smart-government realization (Fathi et al., 2025), data governance in smart government organizations (Kamaneh et al., 2026), smart human-resource governance (Mirzaei et al., 2025), AI-based public-service governance (Zafari & Pour, 2024), smart urban governance (Vakilian et al., 2024), organizational data and smart governance (Tiznaz et al., 2024), and broader managerial, legal, and political requirements of digital transformation (Taghvaei & Rahimi, 2024). Although these studies provide valuable insights, the existing literature remains relatively fragmented, with many studies focusing on individual dimensions rather than developing an integrated framework encompassing data, technology, institutions, management, human capital, participation, transparency, and public value simultaneously.

This fragmentation highlights an important theoretical and practical gap. Smart governance cannot be effectively institutionalized through isolated investments in information technology, artificial intelligence, data analytics, or electronic service systems. Instead, it requires simultaneous alignment among data governance, intelligent decision-making, technological infrastructure, cybersecurity, organizational leadership, regulatory frameworks, interorganizational coordination, human-resource capabilities, digital culture, stakeholder participation, transparency, and public-value creation. International studies across tourism, urban governance, education, political participation, and metropolitan administration similarly show that sustainable smart governance emerges from interactions among technological, institutional, managerial, and societal subsystems rather than from any single factor (Abdelmalak, 2025; Gurram et al., 2025; Margareta et al., 2025; Naveen Kumar et al., 2025; Vaz, 2024). Developing an integrated model can therefore provide both a more comprehensive theoretical understanding and a practical roadmap for public organizations seeking to move from fragmented digitalization toward genuine administrative smartization.

Within this context, large and strategically important governmental institutions such as the Ministry of Petroleum and its affiliated organizations constitute particularly suitable environments for examining the requirements of smart governance because of their organizational complexity, extensive information flows, strategic role, technological intensity, and need for coordination across multiple administrative and operational units. Such institutions require governance models capable of integrating technological infrastructure with data management, managerial authority, regulatory requirements, workforce capabilities, stakeholder relations, and public accountability. A context-sensitive and empirically grounded model can help policymakers and managers identify the dimensions that must be developed simultaneously and provide a basis for evaluating organizational readiness, prioritizing interventions, and guiding the implementation of smart-governance initiatives. Consequently, the present study aimed to identify, design, and validate a comprehensive model for the implementation of smart governance based on administrative smartization in Iranian public-sector organizations.

2. Methods and Materials

In terms of nature, this study falls within the category of qualitative research, and in terms of purpose, it is applied research. Using an exploratory–explanatory approach, the study sought to identify and explain the dimensions, components, and requirements for implementing smart governance based on administrative smartization in public-sector organizations. The qualitative study population consisted of experts, senior and middle managers, and specialists in the fields of smart governance, digital transformation, information technology, public administration, and public policy, who were selected with an emphasis on the Ministry of Petroleum and its affiliated units. Sampling was conducted using a criterion-based purposive approach; that is, participants were selected based on having managerial experience or specialized professional expertise in relevant areas, theoretical and practical familiarity with the concepts of smart governance and administrative smartization, experience participating in digital transformation and information technology projects, and postgraduate academic qualifications. The sampling process continued until theoretical saturation was achieved, that is, until newly collected data no longer yielded new concepts or themes and the existing meaning patterns had reached sufficient theoretical saturation.

Data were collected through two methods: document analysis and semi-structured interviews. In the documentary phase, domestic and international scientific sources, policy documents, specialized reports, and previous relevant studies were systematically reviewed to extract the preliminary theoretical framework and conceptual dimensions of the subject. In the fieldwork phase, semi-structured interviews were conducted with participants, recorded, transcribed, and prepared for analysis.



The data were analyzed using thematic analysis based on Braun and Clarke's (2006) six-phase framework. Following in-depth familiarization with the data, initial codes were generated, basic themes were identified, organizing and overarching themes were developed, and finally, the thematic network was constructed and interpreted. To enhance the scientific rigor of the findings, strategies such as member checking, continuous review and monitoring of the coding process, constant comparison of the data, and detailed documentation of the analytical stages were employed to ensure the dependability, confirmability, and conceptual coherence of the findings.

3. Findings and Results

Based on the review of various sources and interviews with experts in the fields of public administration, governance, information technology, artificial intelligence, administrative system reform, and senior managers of the Ministry of Petroleum, the model for implementing smart governance based on administrative smartization comprised the following stages:

Stage One: Basic Themes. At this stage, the interview transcripts, documents, and theoretical and research foundations were carefully examined by the researcher, and the codes and key points embedded in the concepts presented in Table 1 were selected as basic themes related to the model.

Table 1. Codes and Key Points Identified in the Texts (Basic Themes)

No.	Illustrative Quotation	Basic Variable	Interviewee No.
1	The databases of different agencies should be interconnected so that more accurate decisions can be made.	Integration of databases	9
2	As long as data are not standardized, they cannot be used effectively.	Standardization of organizational data	2
3	Executive agencies should share the required data with one another.	Data exchange among executive agencies	6
4	Organizations require a coherent data architecture for smartization.	Organizational data architecture	1
5	Data validity and accuracy are prerequisites for intelligent decision-making.	Data validation	9
6	Smart governance is not possible without establishing an appropriate data governance system.	Data governance	8
7	Artificial intelligence can analyze enormous volumes of data.	Big data analytics	7
8	Data analysis can be used to identify decision-making patterns.	Identification of decision-making patterns	6
9	Intelligent systems are capable of forecasting future needs.	Forecasting trends and needs	7
10	Intelligent systems can assist managers in decision-making.	Intelligent decision support	10
11	Data-driven decision-making reduces human errors.	Reduction of human errors	5
12	Policies are effective when they are based on data and analysis.	Improvement of policymaking quality	7
13	Development of communication infrastructure is essential for smart governance.	Development of communication networks	5
14	High-speed and secure Internet access is one of the principal requirements of smartization.	High-speed and secure Internet	7
15	Data centers must be expanded to process large-scale data.	Development of data centers	10
16	The implementation of intelligent systems facilitates administrative service delivery.	Implementation of intelligent systems	5
17	Different systems must be capable of interoperability and information exchange.	System interoperability	3
18	Government services should be delivered through an integrated service chain.	Integration of electronic services	5
19	Artificial intelligence is considered a key driver of smart governance.	Application of artificial intelligence	2
20	The Internet of Things can transmit environmental information in real time.	Utilization of the Internet of Things	8
21	The use of emerging technologies accelerates administrative transformation.	Use of emerging technologies	4
22	The smarter systems become, the more important cybersecurity becomes.	Cybersecurity	9
23	Sensitive organizational data must be protected against misuse.	Protection of sensitive data	8
24	Protecting citizens' privacy is a prerequisite for successful smart governance.	Protection of user privacy	3
25	Without the support and commitment of senior managers, smartization projects will not succeed.	Senior management commitment	5
26	Managers must support digital transformation within the organization.	Support for digital transformation	8
27	The smartization process requires continuous and goal-oriented governance and steering.	Smartization governance and steering	10
28	Some existing laws must be revised in accordance with smartization requirements.	Reform of existing laws	6
29	Developing clear regulations in the field of smartization is essential.	Development of smartization regulations	8



30	Implementation of data-management legislation provides the foundation for smart governance.	Implementation of data and information laws	1
31	Overlapping organizational responsibilities hinder the realization of smart governance.	Elimination of overlapping responsibilities	7
32	Successful implementation of programs requires unity of command.	Unity of command	5
33	Cooperation among different agencies creates synergy and increases effectiveness.	Synergy among executive agencies	4
34	Every organization should have a clear smartization roadmap.	Development of a smartization roadmap	1
35	Progress in smartization programs should be continuously evaluated.	Performance monitoring and evaluation	8
36	The greatest challenge in smartization is managing organizational change.	Organizational change management	6
37	Employees require specialized training to work with new technologies.	Specialized employee training	7
38	The shortage of specialized personnel is one of the major barriers to the development of smartization.	Development of specialized human resources	9
39	Digital skills should be developed at all organizational levels.	Development of digital skills	10
40	Employees should be capable of using intelligent systems.	Enhancement of employees' digital literacy	5
41	Without public education, citizens cannot use smart services.	Enhancement of citizens' digital literacy	2
42	The technology access gap among different groups needs to be reduced.	Reduction of the digital divide	8
43	Acceptance of new technologies among employees is essential.	Adoption of new technologies	7
44	Decisions should be based on data and evidence.	Development of a data-driven culture	9
45	Successful organizations are continuously learning and improving.	Strengthening a learning culture	4
46	The benefits of smartization should be explained to employees and the public.	Promotion of smartization benefits	10
47	Continuous communication and information dissemination increase public acceptance.	Public awareness and information dissemination	3
48	Recording and transferring successful experiences play an important role in developing smartization.	Management of knowledge and experiences	8
49	Citizens should participate in public decisions and policies.	Citizen participation	6
50	The private sector can play an effective role in the development of smart services.	Private-sector participation	9
51	Knowledge-based companies are drivers of innovation in smart governance.	Participation of knowledge-based companies	7
52	Publishing public data increases trust and transparency.	Open data publication	10
53	Transparency in administrative processes provides a basis for reducing corruption.	Transparency of administrative processes	5
54	Managers should be accountable for their performance.	Managerial accountability	8
55	Continuous interaction between government and citizens improves the quality of decisions.	Government–citizen interaction	4
56	Government–private-sector collaboration accelerates innovation.	Government–private-sector collaboration	9
57	Universities can provide scientific support for smartization projects.	Government–university collaboration	7
58	Smart services should be designed according to the needs of each individual.	Service personalization	6
59	Smartization improves the quality of public services.	Improvement of service quality	10
60	The ultimate outcome of smart governance is increased public satisfaction and trust.	Increased public satisfaction and trust	5

Stage Two: Organizing Themes. At this stage, the categories derived from combining and synthesizing the basic themes were classified. The results are presented in Table 2.

Table 2. Organizing Themes Related to the Model for Implementing Smart Governance Based on Administrative Smartization

Organizing Themes	Basic Themes
Data integration	Integration of databases; Standardization of organizational data; Data exchange among executive agencies
Data management	Organizational data architecture; Data validation; Data governance
Intelligent data analysis	Big data analytics; Identification of decision-making patterns; Forecasting trends and needs
Data-driven decision-making	Intelligent decision support; Reduction of human errors; Improvement of policymaking quality
Information technology infrastructure	Development of communication networks; High-speed and secure Internet; Development of data centers
Integrated systems	Implementation of intelligent systems; System interoperability; Integration of electronic services
Emerging technologies	Application of artificial intelligence; Utilization of the Internet of Things; Use of emerging technologies
Information security and protection	Cybersecurity; Protection of sensitive data; Protection of user privacy
Leadership and managerial support	Senior management commitment; Support for digital transformation; Smartization governance and steering
Laws and regulations	Reform of existing laws; Development of smartization regulations; Implementation of data and information laws
Interorganizational coordination	Elimination of overlapping responsibilities; Unity of command; Synergy among executive agencies



Planning and governance	Development of a smartization roadmap; Performance monitoring and evaluation; Organizational change management
Human resource development	Specialized employee training; Development of specialized human resources; Development of digital skills
Digital literacy	Enhancement of employees' digital literacy; Enhancement of citizens' digital literacy; Reduction of the digital divide
Smart organizational culture	Adoption of new technologies; Development of a data-driven culture; Strengthening a learning culture
Awareness-building and cultural development	Promotion of smartization benefits; Public awareness and information dissemination; Management of knowledge and experiences
Stakeholder participation	Citizen participation; Private-sector participation; Participation of knowledge-based companies
Transparency and accountability	Open data publication; Transparency of administrative processes; Managerial accountability
Collaboration and interaction	Government–citizen interaction; Government–private-sector collaboration; Government–university collaboration
Improvement of public services	Service personalization; Improvement of service quality; Increased public satisfaction and trust

Stage Three: Overarching Themes. At this stage, the overarching themes were classified through the combination and synthesis of the organizing themes. The results are presented in Table 3.

Table 3. Overarching Themes Related to the Model for Implementing Smart Governance Based on Administrative Smartization

Overarching Themes	Organizing Themes	Basic Themes
Data governance and intelligent decision-making	Data integration	Integration of databases; Standardization of organizational data; Data exchange among executive agencies
Data governance and intelligent decision-making	Data management	Organizational data architecture; Data validation; Data governance
Data governance and intelligent decision-making	Intelligent data analysis	Big data analytics; Identification of decision-making patterns; Forecasting trends and needs
Data governance and intelligent decision-making	Data-driven decision-making	Intelligent decision support; Reduction of human errors; Improvement of policymaking quality
Smartization infrastructure and technologies	Information technology infrastructure	Development of communication networks; High-speed and secure Internet; Development of data centers
Smartization infrastructure and technologies	Integrated systems	Implementation of intelligent systems; System interoperability; Integration of electronic services
Smartization infrastructure and technologies	Emerging technologies	Application of artificial intelligence; Utilization of the Internet of Things; Use of emerging technologies
Smartization infrastructure and technologies	Information security and protection	Cybersecurity; Protection of sensitive data; Protection of user privacy
Managerial and institutional requirements of smart governance	Leadership and managerial support	Senior management commitment; Support for digital transformation; Smartization governance and steering
Managerial and institutional requirements of smart governance	Laws and regulations	Reform of existing laws; Development of smartization regulations; Implementation of data and information laws
Managerial and institutional requirements of smart governance	Interorganizational coordination	Elimination of overlapping responsibilities; Unity of command; Synergy among executive agencies
Managerial and institutional requirements of smart governance	Planning and governance	Development of a smartization roadmap; Performance monitoring and evaluation; Organizational change management
Human capital and smartization culture	Human resource development	Specialized employee training; Development of specialized human resources; Development of digital skills
Human capital and smartization culture	Digital literacy	Enhancement of employees' digital literacy; Enhancement of citizens' digital literacy; Reduction of the digital divide
Human capital and smartization culture	Smart organizational culture	Adoption of new technologies; Development of a data-driven culture; Strengthening a learning culture
Human capital and smartization culture	Awareness-building and cultural development	Promotion of smartization benefits; Public awareness and information dissemination; Management of knowledge and experiences
Participation, transparency, and public value creation	Stakeholder participation	Citizen participation; Private-sector participation; Participation of knowledge-based companies
Participation, transparency, and public value creation	Transparency and accountability	Open data publication; Transparency of administrative processes; Managerial accountability
Participation, transparency, and public value creation	Collaboration and interaction	Government–citizen interaction; Government–private-sector collaboration; Government–university collaboration
Participation, transparency, and public value creation	Improvement of public services	Service personalization; Improvement of service quality; Increased public satisfaction and trust

By synthesizing the views of experts and the theoretical and research foundations, a model for implementing smart governance based on administrative smartization was designed with five dimensions, as illustrated in Figure 1.





Figure 1. Thematic Network of the Model for Implementing Smart Governance Based on Administrative Smartization

4. Discussion and Conclusion

The present study was conducted to identify, design, and validate a comprehensive model for the implementation of smart governance based on administrative smartization in Iranian public-sector organizations. The qualitative analysis resulted in the identification of 60 basic themes, which were subsequently organized into 20 organizing themes and five overarching dimensions: (1) data governance and intelligent decision-making, (2) smartization infrastructure and technologies, (3) managerial and institutional requirements of smart governance, (4) human capital and smartization culture, and (5) participation, transparency, and public value creation. The results of the fuzzy pairwise comparisons further supported the conceptual and empirical validity of these dimensions and indicated that successful smart governance cannot be achieved through the isolated development of a single technological, managerial, or institutional component. Rather, it requires simultaneous alignment and synergy among data, technology, institutional arrangements, leadership, human resources, organizational culture, stakeholder participation, transparency, and service-oriented public value creation. This finding reinforces the conceptualization of smart governance as a multidimensional administrative transformation rather than merely an advanced stage of organizational digitalization.

The first major dimension identified in the study was **data governance and intelligent decision-making**, comprising data integration, data management, intelligent data analytics, and data-driven decision-making. The basic themes within this dimension included database integration, organizational data standardization, interagency data exchange, data architecture, data validation, data governance, big data analytics, identification of decision-making patterns, trend and needs forecasting, intelligent decision support, reduction of human errors, and improvement of policymaking quality. These findings indicate that

data constitute the foundational resource upon which smart governance is constructed. Without reliable, standardized, interoperable, and accessible data, even sophisticated artificial intelligence applications and decision-support technologies cannot provide trustworthy outputs. This result is consistent with research emphasizing the strategic role of data governance in smart government organizations. Kamaneh et al. demonstrated that data governance requires an integrated structure for information management, accountability, data quality, access, and institutional coordination and should be regarded as a prerequisite for the successful functioning of smart government organizations (Kamaneh et al., 2026). Similarly, Emamipannah emphasized that big data analytics can enhance smart management by enabling data-driven governance, more accurate analysis, and technology-based policymaking (Emamipannah, 2025).

The emphasis on intelligent decision-making also corresponds with previous research on artificial intelligence and data-driven public administration. The current findings suggest that smart governance should move public organizations from experience-based or intuition-dominated decision-making toward evidence-based, predictive, and analytically supported decision processes. Zafari and Pour similarly highlighted the opportunities created by data-driven artificial intelligence in public services, particularly its capacity to increase analytical accuracy, accelerate decision-making, and improve public-service responsiveness, while also drawing attention to challenges related to accountability and data governance (Zafari & Pour, 2024). Pei likewise showed that incorporating artificial intelligence into smart policing systems can strengthen prediction, analytical processing, and operational decision-making, although appropriate risk-governance structures are required to manage the technological and institutional risks generated by intelligent systems (Pei, 2025). The present findings therefore extend this line of research by showing that AI-supported decision-making should be embedded within a broader architecture of data standardization, governance, quality assurance, and interorganizational information exchange.

The second overarching dimension was **smartization infrastructure and technologies**, which included information technology infrastructure, integrated systems, emerging technologies, and information security and protection. The results showed that communication networks, high-speed and secure internet access, data centers, intelligent systems, interoperability, integrated electronic services, artificial intelligence, the Internet of Things, emerging technologies, cybersecurity, sensitive-data protection, and user privacy collectively represent the technological foundation of smart governance. This finding indicates that administrative smartization requires an integrated digital ecosystem rather than the fragmented acquisition of separate technological tools. The mere presence of advanced equipment is insufficient if systems cannot communicate with one another or if information cannot move securely across organizational boundaries. The finding is compatible with Gurram et al., who demonstrated that smart governance systems become more effective when artificial intelligence, blockchain, and data-driven management systems are integrated within a hybrid framework rather than implemented separately (Gurram et al., 2025). It is also consistent with the work of Naveen Kumar et al., who emphasized the importance of intelligent technological infrastructures in the governance of smart destinations and in improving the capacity of institutions to deliver adaptive and technology-supported services (Naveen Kumar et al., 2025).

The inclusion of cybersecurity, information protection, and privacy within the technological dimension is particularly significant. Administrative smartization increases organizational dependence on integrated databases, interconnected systems, and automated technologies, which simultaneously increases exposure to cyber threats, unauthorized access, and misuse of sensitive information. Therefore, information security should not be regarded as an auxiliary technological concern but as an essential governance requirement. The results correspond with research indicating that advanced technological ecosystems require accompanying legal, security, and accountability arrangements. Gholampour and Esfandiari, in examining smart-grid governance, showed that technological innovation creates complex legal and governance requirements related to data, ownership, responsibility, and secure digital interactions (Gholampour & Esfandiari, 2025). Similarly, the risk-governance concerns identified in AI-based public-service and policing environments suggest that technological sophistication must be matched by appropriate safeguards for security, privacy, and responsible data use (Pei, 2025; Zafari & Pour, 2024).

The third major dimension was **managerial and institutional requirements of smart governance**, consisting of leadership and managerial support, laws and regulations, interorganizational coordination, and planning and governance. The basic themes indicated that senior-management commitment, support for digital transformation, smartization governance, legislative reform, smartization regulations, implementation of data and information laws, elimination of overlapping responsibilities, unity of

command, interagency synergy, development of a smartization roadmap, performance monitoring, and organizational change management are crucial to implementation. These findings demonstrate that smart governance cannot be institutionalized through technical departments alone. Successful administrative transformation requires senior managers to define strategic direction, allocate resources, coordinate actors, resolve institutional conflicts, and create formal mechanisms for monitoring and accountability. This interpretation aligns with Fathi et al., who identified multiple institutional, managerial, technological, and governance-related factors affecting the realization of smart government in Iran and emphasized that digital governance depends on the interaction of these dimensions rather than on technological capacity alone (Fathi et al., 2025).

The results concerning legal reform and interorganizational coordination are also supported by previous studies. Taghvaei and Rahimi emphasized that government digital transformation occurs at the intersection of management, law, and politics and that smart governance requires the convergence of technological innovation with legal and institutional adaptation (Taghvaei & Rahimi, 2024). Zanoobi et al. similarly identified organizational, structural, technological, and managerial conditions as influential in the development of smart governance during digital transformation (Zanoobi et al., 2024). The present study further indicates that overlapping responsibilities and the absence of unified governance may undermine implementation by producing duplicated initiatives, incompatible systems, and fragmented authority. This observation corresponds with Nasrulhaq's analysis of smart governance experiences in metropolitan cities, which highlighted institutional coordination and administrative integration as important determinants of smart-governance effectiveness (Nasrulhaq, 2025). Consequently, managerial and institutional arrangements appear to serve as the coordinating mechanism through which technological capabilities can be converted into sustainable governance outcomes.

The fourth overarching dimension was **human capital and smartization culture**, encompassing human resource development, digital literacy, smart organizational culture, and awareness-building and cultural development. The extracted themes included specialized employee training, development of specialized human resources, digital skills, employee and citizen digital literacy, reduction of the digital divide, adoption of emerging technologies, development of a data-driven culture, reinforcement of organizational learning, promotion of the benefits of smartization, public awareness, and knowledge and experience management. These findings demonstrate that administrative smartization depends heavily on the capabilities and attitudes of the individuals who interact with digital systems. Advanced technologies cannot improve organizational performance if employees lack the knowledge required to use them or if organizational cultures resist evidence-based and technology-supported practices. Mirzaei et al. similarly showed that smart human resource governance in the Iranian public sector requires alignment among digital competencies, HR governance processes, institutional requirements, and technological transformation (Mirzaei et al., 2025). The current findings therefore suggest that human-resource development must be incorporated into smart-governance strategies from the outset rather than treated as a secondary training activity after technology implementation.

The emphasis on organizational culture and digital literacy is also important because smart governance involves changes in established patterns of authority, communication, decision-making, and work routines. Employees may resist new technologies when they do not understand their value, lack confidence in using them, or perceive them as threats to occupational roles. At the same time, citizens who lack sufficient digital access or literacy may be excluded from smart public services. Thus, administrative smartization should be accompanied by organizational learning, knowledge sharing, public awareness, and efforts to reduce the digital divide. Sulistiyo's research on smart governance and public services supports this interpretation by emphasizing that the success of smart governance depends not only on technological infrastructure but also on institutional readiness, human capabilities, and citizen-oriented service mechanisms (Sulistiyo, 2024). Likewise, Vakilian et al. showed that improvements in good urban governance require the integration of technological and managerial capabilities with institutional and human factors (Vakilian et al., 2024). These findings support the view that smart governance is fundamentally a socio-technical process.

The fifth dimension identified in the study was **participation, transparency, and public value creation**, comprising stakeholder participation, transparency and accountability, collaboration and interaction, and improvement of public services. Basic themes included citizen participation, participation of the private sector and knowledge-based companies, open-data publication, transparency of administrative processes, managerial accountability, government–citizen interaction, government–private-sector collaboration, government–university collaboration, personalized services, improved service quality, and



increased public satisfaction and trust. These results indicate that the ultimate purpose of smart governance extends beyond internal administrative efficiency. Smartization should increase the capacity of government to involve stakeholders, make administrative processes visible, strengthen accountability, deliver more responsive services, and generate tangible public value. Margareta et al. similarly demonstrated that smart-city and e-government initiatives can contribute to greater transparency and accountability in public-service delivery (Margareta et al., 2025). Ashrafi's examination of taxation under

Page | 13 smart governance also illustrates how digital governance mechanisms can strengthen transparency, monitoring, and administrative control in specific public-sector functions (Ashrafi, 2025).

The findings regarding citizen participation and collaborative governance are consistent with studies emphasizing the participatory potential of digital technologies. Vaz showed that online political participation is an important element of smart-city governance and that digital environments can create new mechanisms through which citizens interact with public institutions and participate in collective decision-making (Vaz, 2024). Testi et al. further demonstrated the potential of blockchain technology to support citizen engagement by improving transparency, trust, traceability, and the reliability of digital participation processes (Testi et al., 2025). The present findings extend these observations by showing that participation should include not only citizens but also private-sector organizations, knowledge-based companies, and universities. In this sense, smart governance is increasingly collaborative and ecosystem-based, with public organizations functioning as coordinators of diverse sources of expertise, innovation, technological capacity, and societal knowledge.

The emphasis on public value creation also corresponds with research conducted in other smart-governance contexts. Abdelmalak showed that smart tourism governance requires institutional arrangements capable of simultaneously supporting sustainability, innovation, resilience, and stakeholder coordination (Abdelmalak, 2025). Naveen Kumar et al. similarly linked intelligent technologies and governance mechanisms to improved destination management and more responsive service systems (Naveen Kumar et al., 2025). In urban governance, Vakilian et al. emphasized that smart management can contribute to improved governance outcomes by strengthening participation, service effectiveness, and administrative responsiveness (Vakilian et al., 2024). These studies support the present finding that the success of smart governance should ultimately be assessed in terms of its contribution to citizen satisfaction, trust, service quality, transparency, and collective value rather than solely through technological indicators.

Overall, the integrated model developed in this study suggests that the five dimensions are mutually dependent rather than independent components. Data cannot support intelligent decision-making without appropriate infrastructure; infrastructure cannot be used effectively without managerial leadership and institutional coordination; technological and institutional systems cannot become sustainable without skilled human resources and a supportive organizational culture; and the legitimacy of the entire smart-governance system ultimately depends on participation, transparency, accountability, and the generation of public value. This systemic interpretation is consistent with contemporary studies across different governance domains, including education, tourism, urban management, public services, and metropolitan administration, all of which point toward the necessity of integrating technological, institutional, managerial, and societal dimensions (Abdelmalak, 2025; Gurram et al., 2025; Nasrulhaq, 2025; Sulistiyo, 2024). Therefore, the principal contribution of the present study lies in providing an integrated indigenous framework capable of bringing these previously dispersed elements together within a coherent model of administrative smartization.

The present study was subject to several limitations. First, because the research adopted a qualitative design and purposive sampling strategy, the findings are strongly influenced by the professional experiences, organizational positions, and interpretations of the participating experts and managers. Second, the emphasis on the Ministry of Petroleum and its affiliated units may limit the direct transferability of all identified themes to public organizations with different missions, technological infrastructures, organizational sizes, or regulatory environments. Third, although document analysis and semi-structured interviews provided rich and multidimensional data, self-reported perspectives may have been influenced by participants' organizational experiences or expectations regarding digital transformation. Finally, the rapid development of technologies such as artificial intelligence, blockchain, cloud computing, and the Internet of Things means that some technological and regulatory requirements of smart governance may evolve over time and require periodic revision of the proposed model.



Future studies are recommended to quantitatively test the proposed model using large samples from different ministries, governmental agencies, municipalities, and public enterprises in order to examine its measurement properties, structural relationships, and generalizability. Researchers may develop a standardized questionnaire based on the identified dimensions, organizing themes, and basic indicators and evaluate the model through exploratory and confirmatory factor analysis or structural equation modeling. Comparative research across different public-sector organizations, industries, provinces, or countries could also determine whether the relative importance of the five dimensions varies according to organizational context. Longitudinal studies would be particularly valuable for examining how smart-governance capabilities develop over time and whether improvements in the identified dimensions lead to measurable changes in service quality, administrative efficiency, transparency, public trust, and organizational performance. Future research could also investigate the mediating or moderating roles of organizational readiness, digital maturity, leadership style, cybersecurity capability, employee resistance to change, and citizen digital literacy.

Public-sector managers and policymakers should approach smart governance as an integrated administrative transformation program rather than as a collection of separate information technology projects. Organizations should begin by establishing a coherent data-governance architecture, integrating databases, defining common data standards, improving interoperability, and creating clear responsibilities for data quality and security. At the same time, investment in technological infrastructure should be accompanied by regulatory reform, senior-management commitment, interorganizational coordination, performance monitoring, and structured change management. Public organizations should establish continuous training programs to strengthen digital competencies, promote a data-driven and learning-oriented organizational culture, and reduce resistance to technological change. Mechanisms for open data, citizen participation, managerial accountability, collaboration with universities, knowledge-based companies, and the private sector should also be institutionalized. Finally, implementation performance should be evaluated not merely by the number of digital systems deployed but by tangible improvements in decision quality, service accessibility, transparency, responsiveness, administrative efficiency, citizen satisfaction, and public trust.

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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