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Validation of a Leadership Behavior Model with an Information and Communication Technology Approach in Government Organizations

Ashraf. Jebeli[1], Masoumeh. Jafari[2*], Tahereh. Hasoomi[1]

[1] Department of Management, Ro.C., Islamic Azad University, Roudehen, Iran
[2] Department of Management, ET.C., Islamic Azad University, East Tehran, Iran

*** Corresponding author email address**: m_jafari85@iau.ac.ir

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A B S T R A C T

This study aimed to validate a comprehensive leadership behavior model with an information and communication technology (ICT) approach in government organizations to identify key dimensions and relationships influencing digital transformation and organizational performance. A mixed-methods design was employed, combining qualitative and quantitative approaches. The qualitative phase involved semi-structured interviews with 14 experts, including seven university professors and seven experienced government specialists, to identify main and subthemes of ICT-based leadership behavior. The quantitative phase used a researcher-made questionnaire distributed to 260 employees of the State Organization for Registration of Deeds and Properties, selected via stratified random sampling. Qualitative data were analyzed using thematic analysis, and quantitative data were examined using descriptive statistics, reliability analysis, exploratory factor analysis, and structural equation modeling with SmartPLS. Measurement validity was confirmed through Cronbach's alpha, composite reliability, average variance extracted (AVE), and discriminant validity (HTMT). Structural model evaluation assessed path coefficients, t-values, R^2, and overall fit indices (SRMR, NFI, chi-square). Inferential analysis confirmed that all hypothesized paths were statistically significant ($t > 1.96$, $p < 0.001$), indicating meaningful relationships between the ICT-oriented leadership model and its components. R^2 values demonstrated moderate explanatory power across endogenous variables, confirming that the model effectively explains variance in leadership dimensions such as digital competency, employee empowerment, administrative process transformation, participatory leadership, ethical governance, cybersecurity, and data-driven decision-making. The measurement model demonstrated high reliability (Cronbach's alpha and CR > 0.70), convergent validity (AVE > 0.50), and discriminant validity (HTMT < 0.90). Overall model fit was acceptable, with SRMR = 0.076, NFI = 0.873, and a satisfactory chi-square statistic. The study validated a multidimensional ICT-based leadership behavior model for government organizations, highlighting that effective digital leadership requires integration of technological competence, ethical governance, participatory management, data-driven decision-making, and knowledge management to enhance organizational performance and facilitate sustainable digital transformation.

Keywords: *Digital leadership, ICT, government organizations, structural equation modeling, participatory leadership, ethical governance, digital transformation.*

1. Introduction

Digital transformation has increasingly become a central concern for public and private organizations because it changes not only technological infrastructures but also leadership behaviors, organizational routines, decision-making systems, communication patterns, and service delivery mechanisms. In government organizations, this transformation is especially important because public institutions are expected to provide transparent, responsive, secure, and citizen-oriented services while maintaining administrative accountability and procedural reliability. Information and communication technology (ICT) has therefore moved beyond its earlier role as a technical support function and has become a strategic force that shapes organizational behavior, leadership expectations, institutional agility, and the quality of public service delivery. In this context, leadership behavior is no longer limited to traditional managerial supervision, formal authority, and bureaucratic coordination; rather, leaders are required to guide digital change, support employees in technology adoption, create data-driven cultures, protect information security, and align organizational transformation with public-sector missions. Accordingly, the validation of a leadership behavior model with an ICT approach is necessary for understanding how leaders in government organizations can respond effectively to the requirements of the digital era.

The concept of digital leadership has developed in response to the growing need for leaders who can integrate technological understanding with strategic vision, organizational learning, and human-centered management. Digital leadership refers to the capacity of leaders to guide organizations through technology-enabled change, foster innovation, enhance communication, and create conditions in which digital tools are meaningfully embedded in organizational processes. Recent studies show that digital leadership plays a key role in accelerating digital transformation, strengthening innovation capability, and improving organizational performance (Nasrun, 2025; Zarei & Pashazadeh, 2025). Unlike conventional leadership models that emphasize hierarchical control and routine coordination, digital leadership requires adaptability, technological literacy, openness to innovation, and the ability to manage uncertainty. This shift is evident in studies that examine the relationship between leadership styles and digital transformation, where leadership is presented as a decisive factor in whether digital initiatives become superficial technological changes or deeper organizational transformations (Oliveira & Favaretto, 2025; Sacavém et al., 2025).

Government organizations face specific challenges in digital transformation because they operate within formal rules, legal constraints, public accountability mechanisms, and complex administrative structures. These organizations often deal with resistance to change, legacy systems, fragmented communication infrastructures, and concerns about information security and privacy. Therefore, leadership behavior in government organizations must address both the technical and human dimensions of ICT implementation. Leaders are expected to create a shared understanding of digital change, reduce employees' fear of technology, promote digital competence, and support the transition from traditional administrative behavior to agile and data-informed management. Research on transformational leadership in the digital era indicates that leaders who communicate a compelling vision, encourage employee engagement, and support digital learning are more capable of improving organizational readiness for transformation (Fitriadi et al., 2026). Similarly, studies on digital transformation emphasize that leadership must coordinate cultural, structural, and technological change simultaneously rather than treating digitalization as a purely technical project (Mahroof & Rafi, 2025; Malik et al., 2025).

One of the main dimensions of ICT-oriented leadership behavior is the transformation of leadership style in the digital environment. Leaders must develop future-oriented organizational goals, strengthen technological experience, model practical use of technology, and promote a competitive technological outlook. In digital organizations, leaders are not merely users of technology but also symbolic and behavioral models who influence employees' attitudes toward technological change. The literature on digital business model innovation suggests that digital leadership and platform capabilities can stimulate innovation by enabling organizations to rethink how value is created, delivered, and sustained in digital environments (Ding, 2026). Although this issue has often been discussed in business and start-up contexts, its implications are also relevant for government organizations, where digital platforms, electronic services, and integrated information systems increasingly shape administrative performance and citizen experience.

Another important dimension is employee empowerment through ICT. Digital transformation can fail when employees are not prepared, motivated, or supported to use

new technologies. Therefore, ICT-based employee empowerment requires digital skills training, hardware and software support, technological trust, employee participation in technology development, and motivational mechanisms. The relationship between leadership and employee engagement in digital environments has been emphasized in systematic studies, showing that transformational and digital leadership can increase employees' willingness to participate in organizational change (Fitriadi et al., 2026). Knowledge sharing is also a central mechanism in this process, because digital transformation depends not only on access to technology but also on the circulation of knowledge, experience, and innovation among organizational members (Odai et al., 2025, 2026). In this sense, a valid ICT-based leadership model must explain how leaders empower employees as active participants in digital transformation rather than passive recipients of technological systems.

Digital communication infrastructure is another foundational aspect of leadership behavior in public organizations. Integrated communication systems, secure channels, user-oriented communication, and coordination between central and provincial units are essential for improving organizational responsiveness. The digital era requires leaders to move beyond fragmented communication practices and build infrastructures that support timely information exchange, interdepartmental coordination, and transparent service processes. Studies on digital leadership and organizational culture show that the effectiveness of digital transformation is strongly connected to the ability of leaders to create communication systems that support collaboration and performance (Muis, 2025). In educational and public-sector contexts, leadership, professional development, and digital innovation have also been shown to interact in strengthening institutional competence and improving organizational outcomes (Norman et al., 2025). These findings support the view that leadership behavior should be examined alongside communication infrastructure and organizational learning.

The development of digital leadership competencies is also a major requirement for ICT-oriented public organizations. Leaders must possess digital literacy, ICT-related decision-making skills, the ability to assess digital competence, and the capacity to cultivate digital learning among employees. Without these competencies, leaders may formally support digital transformation while continuing traditional behavioral patterns that limit innovation and participation. Studies on digital-oriented organizations suggest that effective leadership models in such settings must integrate sustainability, competence development, and organizational adaptability (Nasiri Mooseloo & Tabarsa, 2025). In the banking industry, structural models of digital leadership similarly indicate that digital leadership is a multidimensional construct that includes technological understanding, strategic orientation, cultural influence, and capacity for change management (Shateri et al., 2025). These perspectives show that leadership validation studies must identify and test the specific competencies that enable leaders to guide ICT-based transformation.

Administrative process transformation is another essential component of ICT-based leadership behavior in government organizations. In public institutions, technology can mechanize administrative processes, accelerate operations, protect records, and provide organized online services. However, process digitalization requires leadership behaviors that reduce bureaucratic inertia and connect technological tools to service quality, transparency, and procedural efficiency. Research on leadership in digital transformation shows that leaders are central to redesigning processes and aligning digital initiatives with organizational strategy (Sacavém et al., 2025). In government-related and service-oriented contexts, digital transformation also requires change management, personal competence, and leadership integration to optimize protocol and operational performance (Susilowati, 2025). Therefore, in a government organization such as the State Organization for Registration of Deeds and Properties, leadership behavior must be examined in relation to process mechanization, document protection, administrative speed, and online service provision.

Transparency and accountability are among the most important expectations from ICT-based leadership in public organizations. Digital tools can increase managerial transparency, electronic monitoring, citizen oversight, and administrative integrity, but these outcomes depend on leadership commitment to ethical and accountable use of technology. Digital leadership must therefore include behaviors that promote information transparency, prevent misuse of digital systems, and strengthen public trust. Studies on inclusive leadership and organizational reputation in the era of digital transformation suggest that leadership behaviors can shape competitiveness and reputation by influencing inclusiveness, culture, and organizational responsiveness (Rahayu et al., 2025). In addition, research on green leadership, innovation capabilities, and digital transformation indicates that

leadership can connect technological change with broader organizational performance and legitimacy outcomes (Shahzad et al., 2025). These insights are relevant to government organizations because public legitimacy depends heavily on accountability, fairness, and reliable digital governance.

Participatory leadership is also transformed in the digital environment. ICT tools can support internal communication, electronic participation, collaborative decision-making, and faster information flow across organizational levels. Digital participatory leadership requires leaders to use technology not merely for control but also for engagement, consultation, and collective problem-solving. Research on platform leadership in digital transformation enterprises shows that platform-based leadership can influence employee innovative behaviors and shape how employees interact with digital systems (Shie et al., 2025). Although innovation may take different forms in government organizations, the underlying principle remains important: digital platforms change the relationship between leadership, employees, and organizational participation. A validated ICT-oriented leadership behavior model should therefore include participatory mechanisms and digital communication behaviors that improve organizational cohesion.

Digital change management and transition leadership represent another critical domain. Digital transformation often produces resistance because employees may fear job displacement, increased monitoring, skill inadequacy, or loss of familiar work routines. Leaders must therefore manage resistance, build readiness, plan strategically, and align transformation with organizational policies. Studies on talent management during digital transformation show that transformational leadership can reduce resistance to change and support talent development in digital contexts (Mahroof & Rafi, 2025). Similarly, research on learning organizational culture, employee engagement, digital transformation, and sustainable competitive advantage highlights the mediating and enabling role of transformational leadership in sustaining change (Renalwin, 2025). These findings indicate that ICT-oriented leadership behavior must include psychological, cultural, and strategic mechanisms for managing the transition from traditional to digital administration.

Cybersecurity, data protection, and digital privacy are increasingly central to leadership behavior in ICT-based organizations. Government organizations manage sensitive public records and legal information; therefore, digital leadership must include access control, encrypted information protection, cybersecurity auditing, and the promotion of cybersecurity culture. Digital leadership is connected not only to innovation and efficiency but also to digital responsibility and ethical governance. Studies on digital citizenship and knowledge sharing show that responsible digital behavior can support leadership effectiveness, especially in knowledge-intensive and service-sensitive sectors (Saif et al., 2025). Moreover, digital leadership capability and organizational culture have been linked to innovation ecosystems, indicating that leadership must create both enabling and protective conditions for digital development (Sauda Salim Hamdun Al et al., 2025). Thus, any leadership behavior model for government organizations must integrate cybersecurity and privacy protection as core leadership responsibilities.

Data-driven leadership is another emerging requirement in government organizations. ICT systems generate large volumes of operational, administrative, and service data that can support real-time decision-making, predictive decision-making, performance monitoring, and policy alignment. However, the value of data depends on leaders' ability to institutionalize data-driven culture, encourage analytical thinking, document knowledge, and use evidence in decision-making. Recent research on paradoxical leadership suggests that leaders in digital transformation must balance competing demands such as innovation and control, flexibility and stability, and agility and accountability (Su et al., 2026). This is especially relevant for government organizations, where leaders must use data to increase responsiveness while maintaining legal and ethical constraints. A validated model must therefore reflect how leaders use data for decision-making, monitoring, risk management, and organizational learning.

Human resource management is also transformed by ICT-based leadership. Digital systems can support competency management, intelligent workforce allocation, digital justice in human resource processes, and more transparent employee evaluation. However, such systems can also create concerns about surveillance, inequality, and algorithmic bias if not guided by ethical and fair leadership behavior. Studies on HR practices and digital circular economy adoption show that human resource systems and leadership practices must be aligned with digital transformation goals and social performance outcomes (Singh et al., 2025). In government organizations, this alignment is particularly significant because human resource decisions must be perceived as fair, transparent, and consistent with administrative justice. Therefore, ICT-oriented leadership behavior should be

validated not only through technological indicators but also through its implications for employee fairness, competence development, and organizational trust.

Knowledge management and organizational learning provide another major foundation for ICT-based leadership. Digital knowledge management includes knowledge collection, storage, transfer, use, and employee competence enhancement. Leadership behavior shapes whether knowledge remains fragmented or becomes an organizational asset. Studies have shown that knowledge management, digital leadership, and organizational culture can influence employee performance, highlighting the importance of knowledge processes in digital organizations (Muis, 2025). The role of knowledge sharing in strengthening innovation capability during digital transformation has also been emphasized, showing that digital transformational leadership can activate knowledge-based mechanisms for innovation and performance improvement (Odai et al., 2025, 2026). Accordingly, the validation of a leadership behavior model in government organizations should include knowledge management as a central construct.

Finally, ICT-oriented leadership behavior must be understood as an ethical, justice-oriented, and resilience-based phenomenon. Digital leadership is not limited to adopting new technologies; it also includes protecting privacy, ensuring information integrity, developing ethical culture, standardizing services, reducing discrimination, managing digital risks, and improving organizational resilience. Studies on digital leadership and digital transformation consistently show that leadership determines whether technology becomes a source of innovation, sustainability, and organizational improvement or merely a technical layer added to old structures (Malik et al., 2025; Nasrun, 2025; Oliveira & Favaretto, 2025). Because public organizations are accountable to citizens and operate in legally sensitive environments, their leadership models must be empirically validated to ensure that digital transformation is accompanied by transparency, security, participation, justice, and effective service delivery.

The aim of this study was to validate a leadership behavior model with an information and communication technology approach in government organizations.

2. Methods and Materials

This study was conducted using an applied, exploratory, descriptive, and mixed-methods design. The research was applied in terms of purpose because it aimed to validate a practical model of leadership behavior with an information and communication technology approach for use in government organizations. In terms of method, the study followed a qualitative–quantitative mixed design. The qualitative phase was used to identify the main dimensions, components, and indicators of the leadership behavior model, while the quantitative phase was used to validate the extracted model and examine the relationships among its components. The overall logic of the study was inductive, because the initial model was developed through expert interviews and thematic extraction from qualitative data, and then it was statistically tested and validated through survey data. The study was also non-experimental, because the variables were examined in their natural organizational context without manipulation.

The qualitative participants consisted of 14 experts selected through purposive sampling. These participants included 7 university professors with academic expertise in management, leadership, organizational behavior, and information and communication technology, and 7 experienced specialists and senior experts from the practical field of the State Organization for Registration of Deeds and Properties. The selection of experts was based on their scientific knowledge, practical experience, familiarity with government organizations, and ability to provide informed views on leadership behavior and ICT-based organizational transformation. The interviews were conducted over a period of approximately two months. Each interview lasted about 60 to 80 minutes, depending on the depth of responses and the participant's level of engagement with the research topic. Data collection in the qualitative phase continued until sufficient conceptual richness and thematic saturation were achieved.

The quantitative population included 1,000 employees of the State Organization for Registration of Deeds and Properties. Based on the Krejcie and Morgan sample size table, 260 employees were selected as the statistical sample. The sampling method in this phase was stratified random sampling so that different organizational strata could be adequately represented in the sample. After developing the researcher-made questionnaire based on the qualitative findings and expert validation, the questionnaire was distributed among the selected employees. The completed questionnaires were collected and screened before statistical analysis. In addition, before the main quantitative analysis, a preliminary pilot study was conducted with 30 employees of

the organization to examine the reliability of the questionnaire items.

Data collection in the qualitative phase was carried out through in-depth semi-structured interviews. The semi-structured interview was selected because it allowed the researcher to explore the experts' experiences, perceptions, and interpretations while maintaining sufficient flexibility to follow emerging ideas during the interview process. Before conducting the main interviews, an interview guide was prepared based on extensive review of theoretical literature, previous studies, and consultation with specialists. The interview guide included broad and open-ended questions related to leadership behavior, the role of information and communication technology in government organizations, organizational requirements, leadership competencies, technological readiness, communication patterns, decision-making processes, and the behavioral characteristics required from leaders in ICT-oriented public organizations. To improve the clarity and relevance of the interview questions, a small-scale pilot interview was conducted, and the final interview axes were revised accordingly.

During the interviews, the participants were encouraged to explain their views freely and provide examples from academic knowledge or organizational experience. The interviews were recorded with the participants' permission and then transcribed verbatim for analysis. The transcribed texts formed the main qualitative database of the study. Through coding and thematic analysis, initial codes, basic themes, organizing themes, and main themes were extracted. The findings of this phase were used to design the initial conceptual model and to develop the items of the researcher-made questionnaire for the quantitative phase.

The main instrument in the quantitative phase was a researcher-made questionnaire developed from the qualitative findings. The questionnaire items were designed based on the codes and themes extracted from the expert interviews and the initial model of leadership behavior with an ICT approach. After the first draft of the questionnaire was prepared, its face and content validity were examined by university professors and experienced organizational experts. Their comments were used to revise unclear, repetitive, or overlapping items and to ensure that the questionnaire adequately represented the dimensions of the proposed model. The final questionnaire was then prepared for distribution among the statistical sample. To assess reliability before the main analysis, the questionnaire was administered to 30 employees of the State Organization for Registration of Deeds and Properties, and Cronbach's alpha was calculated for the questionnaire and its dimensions. The reliability results were used to confirm the internal consistency of the instrument before conducting the final survey.

In the qualitative phase, data analysis was conducted using thematic analysis. The analysis began simultaneously with data collection so that the researcher could refine the interview process and identify emerging concepts during the study. After each interview was transcribed, the text was read several times to achieve deep familiarity with the data. In the first step, meaningful statements related to leadership behavior, ICT-based leadership, organizational processes, communication systems, decision-making, employee interaction, technological orientation, and government-sector requirements were identified. These meaningful statements were then coded systematically. The initial codes were reviewed, compared, and grouped according to conceptual similarity. In the next stage, related codes were combined into basic themes, and the basic themes were organized into broader thematic categories. The themes were then reviewed to ensure that they accurately represented the coded data and had sufficient internal coherence and external distinction. Finally, the themes were defined, named, and organized into a coherent conceptual structure that formed the basis of the proposed leadership behavior model.

In the quantitative phase, the collected questionnaire data were analyzed using descriptive and inferential statistics. First, the raw data were entered into SPSS and examined for accuracy, completeness, and suitability for statistical analysis. Descriptive statistics, including frequency indices and other relevant descriptive indicators, were used to summarize the demographic and research variables. Reliability analysis was performed using Cronbach's alpha to assess the internal consistency of the questionnaire. Exploratory factor analysis was also used to examine the underlying factor structure of the researcher-made questionnaire and to identify the most important and influential coded variables in the model of leadership behavior with an information and communication technology approach.

After the exploratory analyses, structural equation modeling was used to validate the conceptual model and examine the relationships among its components. SmartPLS2 software was used for partial least squares structural equation modeling. In this stage, the measurement model and structural model were evaluated. The measurement model was assessed through reliability and validity indices, including internal consistency, factor

loadings, convergent validity, and discriminant validity. The structural model was then examined to determine the strength and significance of the relationships among the model components. Path coefficients were used to assess the direct effects among variables, and the overall explanatory power of the model was evaluated. Through this process, the final validated model of leadership behavior with an information and communication technology approach in government organizations was developed and confirmed.

3. Findings and Results

The qualitative findings were obtained through semi-structured interviews with 14 experts, including university professors and experienced specialists from the State Organization for Registration of Deeds and Properties. The interview transcripts were analyzed through thematic analysis, and the extracted codes were organized into subthemes and main themes. The final qualitative model showed that leadership behavior with an information and communication technology approach in government organizations is a multidimensional construct consisting of leadership style transformation, digital competency development, employee empowerment, communication infrastructure, administrative process transformation, digital transparency, participatory leadership, digital change management, cybersecurity, data-driven decision-making, smart public services, human resource optimization, performance monitoring, data-driven culture, digital knowledge management, ethical leadership, administrative justice, digital risk management, organizational decision-making, and digital privacy-oriented leadership.

Table 1

Main and Subthemes Extracted from Expert Interviews

Main theme	Subthemes
Transformation of leadership style in the digital environment	Development of future-oriented organizational goals; strengthening technological experience; expanding the capacity to implement digital projects; stimulating a digital organizational culture; developing a competitive technological outlook; reforming traditional managerial behavior; practical modeling of technology; stabilizing managers' digital literacy; reducing managers' technological fear
ICT-based employee empowerment	Enhancing employees' digital skills; hardware and software support; employee participation in technology development; creating technological trust; incentive and motivational models; technological learning; strengthening employees' digital autonomy; psychological support for employees
Integration and development of communication infrastructure	Development and strengthening of organizational communication infrastructure; communication security; integration of extra-organizational communication; transformation of user-oriented communications
Promotion of digital leadership competencies	Development of managers' digital literacy; development of leadership skills in information and communication technology; cultural development for digital learning; assessment of digital competence
Transformation of administrative processes through technology	Mechanization of registration processes; acceleration of administrative operations; technological protection and maintenance of documents; organized online services
ICT-based managerial transparency and accountability	Transparency of managerial information; digital managerial accountability; development of public electronic monitoring; promotion of digital administrative integrity
Improvement of organizational communication and participatory leadership	Digital intra-organizational communication; digital participatory leadership; improvement of information flow; coherence of headquarters–provincial communication
Change management and digital transition	Culture-building for digital change; management of resistance to technological change; strategic planning for transformation; alignment of transformation with policies
Promotion of data security and cyber protection	Management of digital access control; encrypted protection of information; cybersecurity evaluation and auditing; promotion of cybersecurity culture
Agilization of digital managerial decision-making	Real-time data-driven decision-making; predictive decision-making; acceleration of the decision-making cycle; electronic participation in decision-making
Development of smart and electronic services for citizens	Expansion of online registration services; optimization of user experience; facilitation of electronic financial processes; innovation and ease of use in online access tools
Optimization of human resource management with smart systems	Digitization of human resource information; management of human resource competencies; intelligent allocation of workforce; digital justice in human resource management
Enhancement of organizational monitoring and performance evaluation	Data-driven performance monitoring; smart monitoring tools; digital disciplinary monitoring; coherence of headquarters monitoring
Institutionalization of a data-driven culture	Data-driven decision-making; data analysis in management; knowledge documentation; development of data technology culture
Development of digital knowledge management	Collection and storage of knowledge; transfer of organizational knowledge; exploitation of knowledge; enhancement of employee competencies
Ethical-oriented leadership in the context of information technology	Observance of digital privacy; integrity and accuracy of information; development of an ethical culture in the organization; justice and transparency in services

Development of administrative justice and reduction of discrimination through electronic leadership	Standardization of services; fair monitoring and feedback; development of a justice-oriented culture in the organization; transparency and accountability
Digital risk management and information technology resilience	Identification and analysis of digital risk; resilience programs using technology; resilient leadership; continuous monitoring and control
Organizational decision-making management	Digital tools; transparency in decision-making
Data-driven leadership in promoting digital security and privacy	Data security and privacy; data resilience

Based on the thematic network, the initial model was developed and then entered into the quantitative validation phase. In the quantitative phase, the scores of the variables were calculated from the sum of the questionnaire items related to each component. The descriptive findings showed that the overall behavioral leadership model with an information and communication technology approach had a mean score of 229.4 and a standard deviation of 71.1 among 260 respondents. Among the component-level variables, improvement of organizational communication and participatory leadership had the highest mean score, while promotion of data security and cyber protection, data-driven leadership in promoting digital security and privacy, and institutionalization of a data-driven culture had comparatively lower mean scores because they were measured with fewer items.

Table 2

Descriptive Statistics of the Research Variables

Variable	N	Mean	Standard deviation	Minimum	Maximum
Transformation of leadership style in the digital environment	260	16.1	6.7	5	25
Promotion of digital leadership competencies	260	16.2	7.04	5	25
Ethical-oriented leadership in the context of information technology	260	16.2	6.6	5	25
ICT-based employee empowerment	260	13.3	5.1	4	20
Improvement of organizational communication and participatory leadership	260	19.8	7.4	6	30
Development of administrative justice and reduction of discrimination through electronic leadership	260	16.4	6.1	5	25
Change management and digital transition	260	6.4	2.9	2	10
Transformation of administrative processes through technology	260	12.5	5.4	4	20
Development of smart and electronic services for citizens	260	13.04	5.4	4	20
Integration and development of communication infrastructure	260	12.5	5.3	4	20
Digital risk management and information technology resilience	260	13.2	2.8	4	20
Promotion of data security and cyber protection	260	6.2	2.9	2	10
Data-driven leadership in promoting digital security and privacy	260	6.2	4.2	2	10
Real-time data-driven decision-making	260	9.8	4.3	3	15
Predictive decision-making	260	9.5	5.5	3	15
ICT-based managerial transparency and accountability	260	12.8	5.4	4	20
Enhancement of organizational monitoring and performance evaluation	260	13.05	4.1	4	20
Optimization of human resource management with smart systems	260	9.8	4.2	3	15
Institutionalization of a data-driven culture	260	6.3	2.9	2	10
Development of digital knowledge management	260	9.7	4.1	3	15
Behavioral leadership model with an information and communication technology approach	260	229.4	71.1	100	325

The inferential findings were analyzed using structural equation modeling in SmartPLS version 4. The model evaluation was conducted in three parts: the measurement model, the structural model, and the overall model fit. For the measurement model, reliability was assessed using factor loadings, Cronbach's alpha, and composite reliability. All observed factor loadings were higher than 0.70 and therefore no questionnaire item was removed from the model. Cronbach's alpha and composite reliability values were also higher than 0.70 for all latent variables, confirming the internal consistency of the constructs. Convergent validity was assessed using the average variance extracted, and all AVE values were higher than 0.50. The structural explanatory power of the endogenous variables was assessed through R^2 and adjusted R^2. According to the usual

interpretation of R^2 values, all endogenous variables showed a moderate level of explanatory power.

Table 3

Reliability, Convergent Validity, and Structural Explanatory Indices

Latent variable	Cronbach's alpha	Composite reliability	AVE	R^2	Adjusted R^2	Effect level
Promotion of data security and cyber protection	0.703	0.870	0.770	0.408	0.406	Moderate
Enhancement of organizational monitoring and performance evaluation	0.839	0.892	0.675	0.581	0.579	Moderate
Promotion of digital leadership competencies	0.890	0.919	0.696	0.593	0.592	Moderate
Improvement of organizational communication and participatory leadership	0.855	0.892	0.580	0.573	0.571	Moderate
Optimization of human resource management with smart systems	0.793	0.879	0.707	0.508	0.506	Moderate
Transformation of digital leadership style	0.889	0.918	0.693	0.633	0.632	Moderate
Transformation of administrative processes through technology	0.829	0.887	0.662	0.585	0.583	Moderate
Predictive decision-making	0.813	0.889	0.728	0.524	0.522	Moderate
Real-time data-driven decision-making	0.797	0.880	0.711	0.543	0.542	Moderate
ICT-based employee empowerment	0.801	0.870	0.626	0.525	0.523	Moderate
Development of smart and electronic services for citizens	0.836	0.890	0.670	0.538	0.536	Moderate
Development of administrative justice and reduction of discrimination through electronic leadership	0.824	0.877	0.588	0.555	0.553	Moderate
Development of digital knowledge management	0.779	0.871	0.693	0.475	0.473	Moderate
Ethical-oriented leadership in the context of information technology	0.875	0.909	0.668	0.610	0.608	Moderate
Data-driven leadership in promoting digital security and privacy	0.713	0.874	0.777	0.502	0.500	Moderate
ICT-based managerial transparency and accountability	0.847	0.897	0.686	0.548	0.547	Moderate
Behavioral leadership model with an information and communication technology approach	0.977	0.978	0.572	—	—	—
Digital risk management and information technology resilience	0.814	0.877	0.641	0.546	0.544	Moderate
Change management and digital transition	0.723	0.878	0.783	0.505	0.503	Moderate
Institutionalization of a data-driven culture	0.776	0.899	0.816	0.477	0.475	Moderate
Integration and development of communication infrastructure	0.840	0.893	0.676	0.581	0.580	Moderate

Discriminant validity was examined using the HTMT criterion. All HTMT coefficients were lower than 0.90, which confirmed that the latent variables were empirically distinct from one another. For readability, the HTMT matrix is reported below in compact form. Each row shows the HTMT values of the construct with the preceding constructs.

Table 4

HTMT Values for Discriminant Validity

Code	Construct	HTMT values with preceding constructs
C1	Promotion of data security and cyber protection	—
C2	Enhancement of organizational monitoring and performance evaluation	C1 = 0.67
C3	Promotion of digital leadership competencies	C1 = 0.58; C2 = 0.66
C4	Improvement of organizational communication and participatory leadership	C1 = 0.62; C2 = 0.62; C3 = 0.71
C5	Optimization of human resource management with smart systems	C1 = 0.60; C2 = 0.58; C3 = 0.65; C4 = 0.62
C6	Transformation of digital leadership style	C1 = 0.70; C2 = 0.67; C3 = 0.59; C4 = 0.56; C5 = 0.61
C7	Transformation of administrative processes through technology	C1 = 0.67; C2 = 0.61; C3 = 0.64; C4 = 0.67; C5 = 0.54; C6 = 0.62
C8	Predictive decision-making	C1 = 0.73; C2 = 0.56; C3 = 0.66; C4 = 0.59; C5 = 0.67; C6 = 0.69; C7 = 0.55
C9	Real-time data-driven decision-making	C1 = 0.63; C2 = 0.58; C3 = 0.61; C4 = 0.59; C5 = 0.61; C6 = 0.69; C7 = 0.49; C8 = 0.67

C10	ICT-based employee empowerment	C1 = 0.68; C2 = 0.65; C3 = 0.75; C4 = 0.63; C5 = 0.65; C6 = 0.76; C7 = 0.65; C8 = 0.71; C9 = 0.64
C11	Development of smart and electronic services for citizens	C1 = 0.59; C2 = 0.48; C3 = 0.64; C4 = 0.64; C5 = 0.59; C6 = 0.64; C7 = 0.65; C8 = 0.73; C9 = 0.64; C10 = 0.63
C12	Development of administrative justice and reduction of discrimination through electronic leadership	C1 = 0.63; C2 = 0.69; C3 = 0.60; C4 = 0.65; C5 = 0.63; C6 = 0.68; C7 = 0.59; C8 = 0.61; C9 = 0.65; C10 = 0.66; C11 = 0.70
C13	Development of digital knowledge management	C1 = 0.65; C2 = 0.59; C3 = 0.58; C4 = 0.66; C5 = 0.70; C6 = 0.72; C7 = 0.66; C8 = 0.61; C9 = 0.62; C10 = 0.64; C11 = 0.59; C12 = 0.58
C14	Ethical-oriented leadership in the context of information technology	C1 = 0.68; C2 = 0.64; C3 = 0.57; C4 = 0.65; C5 = 0.55; C6 = 0.66; C7 = 0.63; C8 = 0.65; C9 = 0.73; C10 = 0.61; C11 = 0.61; C12 = 0.70; C13 = 0.72
C15	Data-driven leadership in promoting digital security and privacy	C1 = 0.66; C2 = 0.59; C3 = 0.63; C4 = 0.66; C5 = 0.61; C6 = 0.65; C7 = 0.56; C8 = 0.56; C9 = 0.61; C10 = 0.72; C11 = 0.56; C12 = 0.67; C13 = 0.64; C14 = 0.60
C16	ICT-based managerial transparency and accountability	C1 = 0.71; C2 = 0.69; C3 = 0.61; C4 = 0.65; C5 = 0.64; C6 = 0.71; C7 = 0.63; C8 = 0.67; C9 = 0.65; C10 = 0.68; C11 = 0.62; C12 = 0.66; C13 = 0.67; C14 = 0.63; C15 = 0.70
C17	Behavioral leadership model with an ICT approach	C1 = 0.65; C2 = 0.65; C3 = 0.62; C4 = 0.62; C5 = 0.59; C6 = 0.73; C7 = 0.62; C8 = 0.64; C9 = 0.68; C10 = 0.75; C11 = 0.68; C12 = 0.67; C13 = 0.59; C14 = 0.67; C15 = 0.64; C16 = 0.63
C18	Digital risk management and information technology resilience	C1 = 0.62; C2 = 0.56; C3 = 0.61; C4 = 0.68; C5 = 0.63; C6 = 0.67; C7 = 0.64; C8 = 0.72; C9 = 0.61; C10 = 0.70; C11 = 0.62; C12 = 0.59; C13 = 0.67; C14 = 0.70; C15 = 0.66; C16 = 0.62; C17 = 0.61
C19	Change management and digital transition	C1 = 0.86; C2 = 0.81; C3 = 0.83; C4 = 0.78; C5 = 0.82; C6 = 0.88; C7 = 0.82; C8 = 0.82; C9 = 0.77; C10 = 0.89; C11 = 0.81; C12 = 0.84; C13 = 0.85; C14 = 0.79; C15 = 0.82; C16 = 0.82; C17 = 0.80; C18 = 0.81
C20	Institutionalization of a data-driven culture	C1 = 0.74; C2 = 0.78; C3 = 0.77; C4 = 0.74; C5 = 0.75; C6 = 0.85; C7 = 0.78; C8 = 0.77; C9 = 0.78; C10 = 0.74; C11 = 0.74; C12 = 0.75; C13 = 0.74; C14 = 0.70; C15 = 0.77; C16 = 0.75; C17 = 0.84; C18 = 0.84; C19 = 0.76
C21	Integration and development of communication infrastructure	C1 = 0.77; C2 = 0.75; C3 = 0.78; C4 = 0.74; C5 = 0.80; C6 = 0.81; C7 = 0.77; C8 = 0.78; C9 = 0.75; C10 = 0.77; C11 = 0.75; C12 = 0.74; C13 = 0.72; C14 = 0.77; C15 = 0.74; C16 = 0.72; C17 = 0.80; C18 = 0.85; C19 = 0.77; C20 = 0.78

The overall model fit was examined using SRMR, chi-square, and NFI. The SRMR value was 0.076, which was lower than the acceptable threshold of 0.08. The NFI value was 0.873, indicating an acceptable level of model fit because values closer to 1 represent better fit. Therefore, the overall fit indices supported the adequacy of the structural equation model.

Table 5

Overall Model Fit Indices

Fit index	Value	Interpretation
SRMR	0.076	Acceptable because it is lower than 0.08
Chi-square	4866.2	Reported as the model chi-square value
NFI	0.873	Acceptable because it is close to 1

The structural model results showed that all paths from the behavioral leadership model with an information and communication technology approach to its components were statistically significant. All t-values were greater than 1.96, and all significance levels were reported as 0.000, indicating significance at $p < 0.001$. The strongest path coefficient belonged to transformation of leadership style in the digital environment, followed by ethical-oriented leadership in the context of information technology, promotion of digital leadership competencies, transformation of administrative processes through technology, enhancement of organizational monitoring and performance evaluation, and integration and development of communication infrastructure. These findings confirmed that the proposed model had significant explanatory relationships with all identified dimensions.

Table 6

Path Coefficients of the Structural Model

Path	Path coefficient	t-value	p-value	Result
Behavioral leadership model with an ICT approach → Promotion of data security and cyber protection	0.639	19.16	<0.001	Significant
Behavioral leadership model with an ICT approach → Enhancement of organizational monitoring and performance evaluation	0.762	31.82	<0.001	Significant
Behavioral leadership model with an ICT approach → Promotion of digital leadership competencies	0.770	34.03	<0.001	Significant
Behavioral leadership model with an ICT approach → Improvement of organizational communication and participatory leadership	0.757	29.78	<0.001	Significant
Behavioral leadership model with an ICT approach → Optimization of human resource management with smart systems	0.713	23.62	<0.001	Significant
Behavioral leadership model with an ICT approach → Transformation of leadership style in the digital environment	0.796	36.99	<0.001	Significant
Behavioral leadership model with an ICT approach → Transformation of administrative processes through technology	0.765	34.36	<0.001	Significant
Behavioral leadership model with an ICT approach → Predictive decision-making	0.724	26.96	<0.001	Significant
Behavioral leadership model with an ICT approach → Real-time data-driven decision-making	0.737	28.56	<0.001	Significant
Behavioral leadership model with an ICT approach → ICT-based employee empowerment	0.724	26.70	<0.001	Significant
Behavioral leadership model with an ICT approach → Development of smart and electronic services for citizens	0.733	27.49	<0.001	Significant
Behavioral leadership model with an ICT approach → Development of administrative justice and reduction of discrimination through electronic leadership	0.745	28.42	<0.001	Significant
Behavioral leadership model with an ICT approach → Development of digital knowledge management	0.689	23.13	<0.001	Significant
Behavioral leadership model with an ICT approach → Ethical-oriented leadership in the context of information technology	0.781	34.30	<0.001	Significant
Behavioral leadership model with an ICT approach → Data-driven leadership in promoting digital security and privacy	0.708	24.19	<0.001	Significant
Behavioral leadership model with an ICT approach → ICT-based managerial transparency and accountability	0.740	29.75	<0.001	Significant
Behavioral leadership model with an ICT approach → Digital risk management and information technology resilience	0.739	28.64	<0.001	Significant
Behavioral leadership model with an ICT approach → Change management and digital transition	0.711	24.23	<0.001	Significant
Behavioral leadership model with an ICT approach → Institutionalization of a data-driven culture	0.691	22.56	<0.001	Significant
Behavioral leadership model with an ICT approach → Integration and development of communication infrastructure	0.762	31.10	<0.001	Significant

Overall, the findings confirmed the validity of the leadership behavior model with an information and communication technology approach in government organizations. The qualitative phase identified the conceptual structure of the model, while the quantitative phase confirmed the reliability, convergent validity, discriminant validity, overall model fit, and significance of the structural paths. Therefore, the final validated model can be considered a multidimensional framework for explaining and assessing leadership behavior in ICT-oriented government organizations.

Figure 1

Model with Beta Coefficients

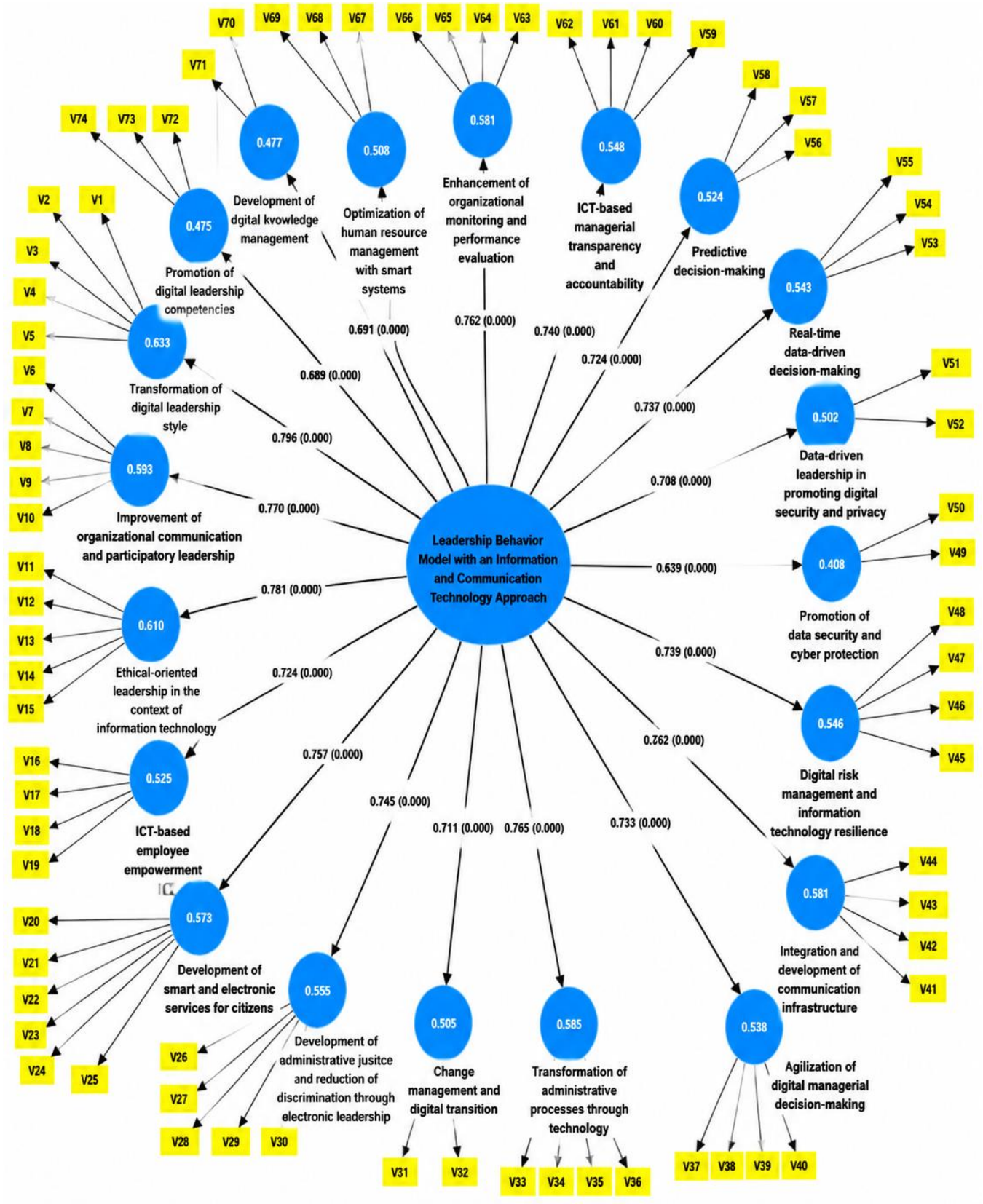

Figure 2

Model with T-Values

4. Discussion and Conclusion

The findings of this study provide substantial evidence supporting the validity of a leadership behavior model with an information and communication technology (ICT) approach in government organizations. The qualitative phase revealed a comprehensive network of themes that emphasized the multidimensional nature of ICT-oriented leadership, including digital competency development, employee empowerment, organizational communication, administrative process transformation, ethical leadership, participatory management, cybersecurity, data-driven decision-making, human resource optimization, and digital

knowledge management. These qualitative results underscore the complexity of leadership in digital environments, indicating that effective leadership in government organizations requires simultaneous attention to technological, organizational, cultural, and ethical dimensions. This aligns with prior studies emphasizing the need for leaders who can integrate multiple dimensions of digital transformation rather than focusing solely on technological adoption (Oliveira & Favaretto, 2025; Sacavém et al., 2025).

Quantitative analysis confirmed the robustness of the model. All latent variables demonstrated high internal consistency with Cronbach's alpha and composite reliability values exceeding 0.70, while convergent validity was supported with AVE values above 0.50. Discriminant validity was confirmed using the HTMT criterion, with all values below 0.90, indicating that constructs were empirically distinct. Structural equation modeling demonstrated that all hypothesized paths from the ICT-based leadership model to its components were statistically significant, with t-values greater than 1.96 and p-values below 0.001. Moreover, the overall model fit indices—including SRMR, NFI, and chi-square—were within acceptable thresholds, confirming that the proposed conceptual structure adequately explains leadership behavior in digital government organizations. These findings are consistent with prior research demonstrating that ICT-based leadership models require strong internal reliability and structural coherence to predict digital transformation outcomes effectively (Ding, 2026; Odai et al., 2026; Su et al., 2026).

The dimension of transformation of leadership style in the digital environment emerged as a highly influential factor in this study. Leaders were found to require not only future-oriented strategic thinking but also practical modeling of technology use and promotion of competitive technological perspectives. This finding is aligned with research indicating that digital leadership involves both symbolic and operational behaviors, where leaders serve as exemplars of digital competence and innovation adoption (Fitriadi et al., 2026; Malik et al., 2025). The emphasis on technological experience and risk reduction also supports findings from start-up and public-sector studies, which suggest that leaders' personal digital literacy and ability to mitigate technological fear significantly affect the success of digital transformation initiatives (Ding, 2026; Nasrun, 2025).

ICT-based employee empowerment was another key component validated in this study. Empowering employees through digital skills development, participatory engagement in technology initiatives, and the creation of technological trust proved essential for facilitating digital adoption. This outcome resonates with previous studies that highlight the role of transformational and digital leadership in promoting employee engagement, organizational learning, and innovation during technological change (Fitriadi et al., 2026; Mahroof & Rafi, 2025; Odai et al., 2025). The structural model indicates that employee empowerment mediates the effectiveness of leadership on other outcomes such as participatory communication, decision-making efficiency, and service quality. This aligns with studies in Sub-Saharan Africa and Southeast Asia, which found that knowledge sharing and employee engagement are critical mechanisms through which digital leaders enhance innovation capability and organizational performance (Odai et al., 2026; Su et al., 2026).

The study further demonstrated the importance of integrated and developed communication infrastructure. Leaders who establish secure, coordinated, and user-oriented communication systems enhance internal collaboration, facilitate timely information flow, and strengthen organizational responsiveness. This finding is in accordance with prior literature emphasizing that digital leaders must design communication infrastructures that support collaborative decision-making and maintain alignment with organizational goals (Muis, 2025; Sacavém et al., 2025). In government organizations, where transparency and accountability are legally mandated, such communication systems not only improve operational efficiency but also reinforce public trust, which is consistent with studies highlighting leadership's role in shaping organizational culture and citizen-centric service delivery (Rahayu et al., 2025).

The promotion of digital leadership competencies emerged as another critical dimension. Leaders must possess digital literacy, ICT decision-making skills, and the capacity to cultivate digital learning within their teams. The significant path coefficients for this construct indicate that digital competencies directly influence other leadership behaviors and organizational outcomes. These results align with studies proposing effective digital leadership models that incorporate technical knowledge, strategic foresight, and organizational sustainability (Nasiri Mooseloo & Tabarsa, 2025; Shateri et al., 2025). This suggests that leadership development programs in government organizations should emphasize competency-building in

digital strategy, data literacy, and ethical decision-making to ensure effective digital transformation.

Administrative process transformation was validated as an essential construct. Leaders who facilitate mechanization of registration processes, acceleration of administrative operations, and online service organization enable more efficient workflows and improve citizen experiences. Prior studies in digital government and e-government contexts similarly indicate that leaders who actively manage administrative digitalization can enhance service quality, procedural transparency, and operational efficiency (Oliveira & Favaretto, 2025; Shahzad et al., 2025). This finding demonstrates the interconnectedness between leadership behavior and technological infrastructure; leaders must simultaneously support cultural and procedural adjustments to maximize the benefits of ICT.

Ethical leadership, transparency, and participatory management were strongly reinforced in the results. Leaders who actively foster ethical conduct, data protection, accountability, and participatory decision-making contribute to organizational resilience and legitimacy. These findings support research emphasizing that leadership in digital transformation is not solely about technological adoption but also about ethical stewardship, fairness, and inclusion (Renalwin, 2025; Sauda Salim Hamdun Al et al., 2025; Su et al., 2026). In government organizations, these behaviors are particularly critical because leaders must navigate the balance between innovation, efficiency, and public trust. Digital participatory leadership facilitates employee engagement, improves intra-organizational communication, and enhances collaborative problem-solving, confirming prior empirical evidence from studies on platform leadership and employee deviance in innovation-oriented digital enterprises (Shie et al., 2025).

Cybersecurity, data protection, and data-driven decision-making were validated as foundational constructs. Leaders who manage digital risk, implement access controls, enforce encrypted data protection, and institutionalize a culture of data-driven decision-making significantly influence organizational resilience. This result aligns with literature on digital governance and leadership in knowledge-intensive organizations, emphasizing that leaders' capability to integrate security, ethical governance, and data utilization determines the success of digital transformation (Odai et al., 2025; Saif et al., 2025). These findings indicate that ICT-oriented leadership models must incorporate both technical and behavioral elements to ensure secure, responsive, and accountable organizational operations.

Human resource management and knowledge management were also highlighted as key domains. Leaders who optimize human resources through digital systems, manage competencies, allocate work intelligently, and maintain fairness contribute to organizational performance and employee engagement. Knowledge management, including the collection, storage, transfer, and exploitation of organizational knowledge, is enhanced when leaders actively support knowledge sharing and digital learning, which is consistent with studies showing the role of digital leadership in promoting organizational learning, innovation, and sustainable competitive advantage (Muis, 2025; Odai et al., 2026). This indicates that leadership behavior should be evaluated not only in technological terms but also through its effects on human capital and knowledge assets.

Overall, the structural model demonstrated significant path coefficients for all constructs, with all t-values exceeding the 1.96 threshold, confirming the predictive validity of the model. The R^2 values indicated moderate explanatory power for all endogenous variables, demonstrating that the model can adequately explain variance in organizational outcomes, including employee empowerment, process efficiency, digital literacy, ethical leadership, participatory management, cybersecurity, and service innovation. These findings are consistent with the growing body of research on digital leadership and digital transformation, which underscores the interdependency between leadership behavior, technology adoption, organizational culture, and employee engagement (Ding, 2026; Fitriadi et al., 2026; Malik et al., 2025; Nasrun, 2025; Su et al., 2026).

The study confirms that digital leadership in government organizations is a multidimensional construct. Leaders must simultaneously address technological adoption, organizational transformation, ethical stewardship, employee empowerment, knowledge management, and risk management. This holistic perspective is supported by prior studies suggesting that transformational and digital leadership are critical for driving innovation, reducing resistance to change, and ensuring sustainable performance during digitalization initiatives (Mahroof & Rafi, 2025; Nasiri Mooseloo & Tabarsa, 2025; Shateri et al., 2025). Furthermore, the findings highlight the importance of validating leadership models empirically, as theoretical propositions about digital leadership require operationalization and testing to inform leadership development and public-sector policy implementation (Oliveira & Favaretto, 2025; Sacavém et al., 2025).

Despite the robust methodological design, this study has several limitations. First, the sample for the quantitative phase was limited to employees of a single government organization, which may reduce the generalizability of the results to other public institutions with different structures or service missions. Second, the qualitative phase relied on expert interviews, which, although providing rich data, may reflect subjective interpretations and biases inherent in individual experiences. Third, the cross-sectional nature of the survey data prevents assessment of causal relationships over time; longitudinal studies would be necessary to confirm the stability and dynamics of ICT-based leadership behaviors. Fourth, while the study incorporated multiple constructs, there may be additional variables influencing digital transformation outcomes, such as political pressures, inter-agency collaboration, or national ICT policy environments, which were not included. Finally, self-reported data from questionnaires may be susceptible to social desirability bias, particularly in assessing sensitive topics like ethical leadership, fairness, or cybersecurity practices.

Future research should aim to replicate and extend the findings of this study in other government contexts and across different cultural and organizational settings. Comparative studies involving multiple agencies or cross-national public institutions could provide insights into contextual effects on ICT-oriented leadership behaviors. Longitudinal research is recommended to examine the evolution of leadership practices as digital transformation progresses, which would allow for a deeper understanding of causal mechanisms and temporal effects. Additionally, future studies could incorporate mixed-method approaches that integrate behavioral observations, performance metrics, and citizen feedback to complement self-reported data. Further research could also investigate additional moderators and mediators, such as organizational culture, employee readiness, technological infrastructure, and policy frameworks, to enhance the explanatory power of ICT-based leadership models. Finally, emerging leadership paradigms, such as paradoxical leadership, ethical AI governance, and platform leadership, may provide fertile ground for theoretical refinement and empirical testing in public-sector digital contexts.

From a practical standpoint, government organizations should prioritize leadership development programs that integrate ICT competency, transformational leadership, and ethical governance. Leaders should be trained not only in technology adoption but also in strategic communication, participatory decision-making, cybersecurity management, knowledge management, and change facilitation. Organizations should invest in infrastructure that enables secure, integrated, and citizen-oriented services while providing employees with training and support to navigate digital tools effectively. Policy frameworks should encourage leaders to implement data-driven decision-making processes, promote transparency, and monitor performance systematically. Finally, government institutions should cultivate a culture that aligns ethical leadership, organizational justice, and resilience with digital transformation initiatives, ensuring that technology adoption enhances public value and organizational effectiveness rather than simply introducing technical complexity.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were considered.

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