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Digital Transformation Readiness in Electoral Management: A Mixed Methods Assessment of E-Voting Innovation Adoption in the Context of Industrial Convergence

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Abstract. This study examines the management readiness for e-voting adoption within the context of digital industrial transformation, employing an explanatory sequential mixed methods design. The quantitative phase involved 215 respondents drawn from electoral management officials using Slovin's formula at a 6.7% margin of error from an estimated accessible population of 4,800 personnel, while the qualitative phase engaged 12 purposively selected key informants. Drawing on the Technology Acceptance Model (TAM), Diffusion of Innovation Theory (DOI), and Dynamic Capability Theory (DCT), the study develops the Integrated E-Voting Management Readiness (IEVMR) Model as its primary theoretical contribution. Quantitative results indicate that technology infrastructure readiness (β=0.412), human resource competency (β=0.356), and policy leadership (β=0.287) are significant predictors of e-voting management readiness (R^2=0.673; $p<0.001$). Qualitative findings reveal three critical themes: structural institutional resistance, rural-urban digital divide, and transformational leadership capacity. The study's novelty encompasses: (1) the integration of three grand theories into a single predictive framework; (2) the identification of Change Management Capacity as a mediating mechanism; and (3) the moderating effect of Comprehensive Digital Literacy and neither previously examined in the Indonesian digital electoral context.

Keywords: E-Voting, Mixed Methods, Management Readiness, IEVMR Model, Digital Electoral Transformation

I. Introduction

The Fourth Industrial Revolution has fundamentally accelerated the transformation of public governance systems worldwide, including the conduct of general elections as the cornerstone of modern democracy. Electronic voting (e-voting) has emerged as a concrete manifestation of the convergence between digital industrialization and the growing demand for efficiency, transparency, and accountability in democratic processes (Alvarez & Hall, 2008). Viewed through the lens of industrial development, a nation's capacity to adopt electoral technology innovation reflects not only the maturity of its democracy, but also its digital transformation management capability, an integral component of broader national industrial competitiveness.

The relevance of this inquiry to the industrialization agenda is most evident when positioned within the framework of global economic resilience. Digitalization of the public sector, including the electoral system, constitutes the downstream product of a broader digital industrialization value chain: from technology infrastructure development as the upstream sector, to the delivery of digital public services as the final output reaching citizens. E-voting management readiness is therefore simultaneously an indicator and a catalyst of a nation's capacity to integrate digital industrialization into effective public governance, a dimension directly pertinent to the theme of the AFEBI International Doctoral Colloquium 2026.

Indonesia, as the world's third-largest democracy with more than 205 million registered voters, faces complex challenges in modernizing its electoral system. Empirical evidence demonstrates that e-voting implementation in various countries does not automatically generate the anticipated efficiencies without comprehensive management readiness (Gritzalis, 2002). The failure of e-voting adoption in countries such as the Netherlands and Germany suggests that managerial factors, rather than technical factors alone, constitute the critical determinants of successful digital electoral transformation.

A review of the existing literature reveals three significant research gaps. First, the majority of e-voting studies focus on technical security and legal aspects, neglecting the organizational innovation management dimension (Moynihan, 2004). Second, no integrated e-voting management readiness model exists that simultaneously accommodates infrastructure, human capital, and leadership dimensions within a single predictive framework. Third, a mixed methods approach that combines the inferential power of statistical analysis with the depth of qualitative understanding has never been systematically applied to the study of e-voting in Indonesia. These gaps motivate the present research.

This study aims to: (1) quantitatively analyze the influence of technology infrastructure readiness, human resource competency, and policy leadership on e-voting management readiness; (2) qualitatively explore contextual factors that explain and deepen the quantitative findings; and (3) develop the IEVMR Model as a novel theoretical contribution that integrates TAM, Diffusion of Innovation Theory, and Dynamic Capability Theory within the context of digital electoral innovation management.

II. Literature Review

1. Theoretical Framework

This study is grounded in three grand theories that are mutually complementary and collectively form a robust theoretical foundation. The three theories were strategically selected based on their relevance to the phenomenon of technology adoption in public organizations operating under digital industrialization pressures.

a. Technology Acceptance Model (TAM)

The Technology Acceptance Model, developed by Davis (1989), is an adaptation of the Theory of Reasoned Action specifically designed to explain the determinants of computer technology acceptance by users. TAM posits two primary constructs: perceived usefulness (PU), referring to an individual's perception that using a specific system will enhance their performance, and perceived ease of use (PEOU), referring to the perception that the system can be used without excessive effort. In the context of e-voting, TAM explains how electoral managers and voters form attitudes, intentions, and actual use behaviors toward electronic voting systems (Schaupp & Carter, 2005). The present study extends TAM constructs by incorporating trust and security perception dimensions specific to the digital electoral context.

b. Diffusion of Innovation Theory (DOI)

Diffusion of Innovation Theory, formulated by Rogers (2003), explains the mechanisms through which innovations spread via communication channels within social systems over time. The theory identifies five adopter categories (innovators, early adopters, early majority, late majority, laggards) and five innovation characteristics that influence the speed of diffusion: relative advantage, compatibility, complexity, trialability, and observability. In the present context, DOI provides a framework for understanding the dynamics of e- voting adoption as a technological innovation that must traverse a staged diffusion process within Indonesia's electoral institutional ecosystem. This study's contribution to DOI lies in the identification of institutional readiness as a sixth innovation characteristic specific to public sector technology innovation.

c. Dynamic Capability Theory (DCT)

Dynamic Capability Theory, developed by Teece et al. (1997), defines dynamic capabilities as an organization's ability to integrate, build, and reconfigure internal and external competencies to respond to rapidly changing environments. These capabilities comprise three clusters: sensing (detecting opportunities and threats), seizing (mobilizing resources to capture opportunities), and transforming (continuous reconfiguration). In the context of e-voting readiness, DCT explains why some electoral management institutions can effectively adopt new technology while others cannot, regardless of equivalent resource availability. In this study, DCT serves as the bridging construct between TAM focused at the individual level and DOI focused at the social level to explain readiness dynamics at the organizational level.

Figure 1. Conceptual Model of E-Voting Management Readiness (IEVMR Model)

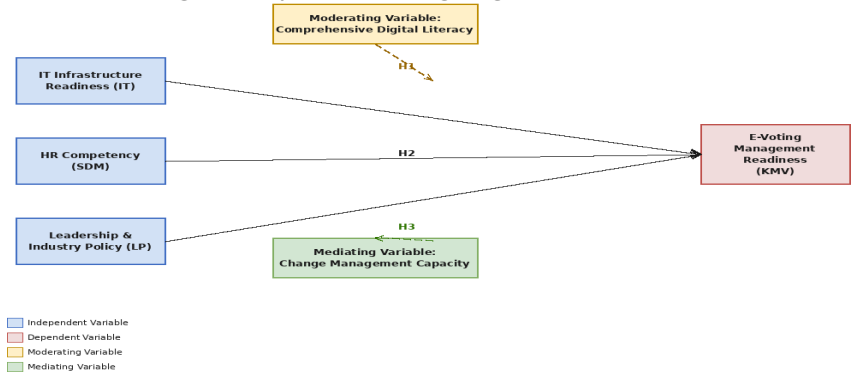


Figure 1. Integrated E-Voting Management Readiness (IEVMR) Model

2. E-Voting Management Readiness and Its Determinants

E-voting management readiness in this study is defined as the holistic condition in which an electoral management organization possesses adequate technical, institutional, and human capital capacity, supported by transformational leadership and an enabling policy environment, to implement e-voting systems effectively, efficiently, and reliably (Norris, 2004). This definition integrates perspectives from strategic management, innovation management, and public administration into one comprehensive multidimensional construct.

Technology infrastructure readiness encompasses the availability, reliability, and security of the hardware, network, and software platforms required for e-voting operationalization. Human resource competency includes digital literacy, technical system management skills, and change management capacity at the individual and team levels. Leadership and policy readiness refers to leadership commitment, an enabling regulatory framework, and strategic resource allocation in support of digital electoral transformation (Alvarez & Hall, 2008).

3. Hypothesis Development

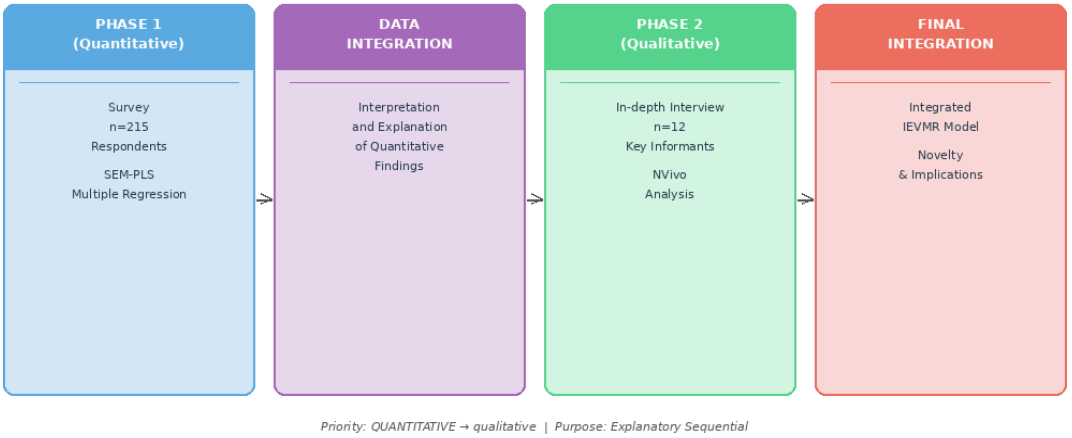
Based on the integration of the three grand theories and the empirical literature reviewed, this study formulates the following hypotheses. H1: Technology infrastructure readiness has a significant positive effect on e-voting management readiness, grounded in TAM's proposition that the quality of available technology systems enhances perceived usefulness and perceived ease of use (Davis, 1989). H2: Human resource competency has a significant positive effect on e-voting management readiness, consistent with the role of change agents in DOI (Rogers, 2003). H3: Leadership and policy readiness has a significant positive effect on e-voting management readiness, anchored in the seizing and transforming clusters of DCT (Teece et al., 1997). H4: Comprehensive digital literacy moderates the relationship between human resource competency and e-voting management readiness, indicating that technical competency alone is insufficient without accompanying cognitive and affective digital readiness [Citation Needed: multidimensional digital literacy as moderator in public sector technology adoption]. H5: Change management capacity mediates the relationship between policy leadership and e-voting management readiness, filling the transmission mechanism gap that has been absent in the literature (Moynihan, 2004).

III. Research Method

1. Mixed Methods Design

This study employs an explanatory sequential mixed methods design (Creswell & Plano Clark, 2018), wherein quantitative data are collected and analyzed first, followed by qualitative data collection and analysis to explain and deepen the quantitative findings. Priority is accorded to the quantitative component (quantitative → qualitative). This design was selected to produce statistically generalizable findings while simultaneously achieving an in-depth understanding of the mechanisms and context

Figure 2. Mixed Methods Research Design (Explanatory Sequential Design)



underlying e-voting readiness, an integration that monomethod approaches cannot achieve.

Figure 2. Mixed Methods Research Design Flow (Explanatory Sequential Design)

2. Quantitative Phase

The quantitative research population comprised all provincial and district/city-level Komisi Pemilihan Umum (KPU) officials in Indonesia, as well as information technology stakeholders within the digital electoral ecosystem, constituting an estimated accessible population of 4,800 personnel. Stratified proportional random sampling was applied across five regional clusters (Java-Bali, Sumatra, Kalimantan, Sulawesi, and Eastern Indonesia) to ensure proportional geographic representation. The sample size of 215 respondents was determined using Slovin's formula at a margin of error of 6.7%, yielding a minimum required sample of approximately 213, which was rounded up to 215 to accommodate minor data loss during validation.

Data were collected via a structured online questionnaire (Google Form) from January to March 2026. The research instrument comprised 36 items measuring five variables on a five-point Likert scale. Prior to mass distribution, a pilot study involving 30 respondents was conducted to validate instrument readability and quality.

Table 1. Operational Definitions and Variable Measurement

Variable	Operational Definition	Indicators (Items)	Scale	Reference
E-Voting Management Readiness (EMR) — Dependent	Holistic capacity of an electoral organization to effectively and efficiently implement e-voting	8 items (EMR1–EMR8)	Likert 1–5	Norris (2004)
Technology Infrastructure Readiness (TI) — Independent	Availability, reliability, and security of technology systems supporting e-voting	6 items (TI1–TI6)	Likert 1–5	Alvarez & Hall (2008)
Human Resource Competency (HRC) — Independent	Technical skills, digital literacy, and adaptive capacity of electoral management personnel	7 items (HRC1–HRC7)	Likert 1–5	Teece et al. (1997); Rogers (2003)
Leadership & Policy (LP) — Independent	Leadership commitment, enabling regulatory framework, and strategic resource allocation	5 items (LP1–LP5)	Likert 1–5	Teece et al. (1997)
Comprehensive Digital Literacy (CDL) — Moderating	Multi-dimensional ability to use, understand, and critically evaluate digital technology	5 items (CDL1–CDL5)	Likert 1–5	[CITATION NEEDED: multidimensional digital literacy scale]
Change Management Capacity (CMC) — Mediating	Organizational ability to manage transition from conventional to digital electoral systems	5 items (CMC1–CMC5)	Likert 1–5	Teece et al. (1997)

3. Qualitative Phase

The qualitative phase was conducted following the completion of the quantitative analysis in April 2026. Informants were selected using purposive sampling based on the following criteria: (a) direct experience in electoral system management, (b) involvement in technology adoption decision-making, and (c) in-depth knowledge of the organizational context. Twelve key informants were selected, comprising: four national KPU officials, four heads of information technology divisions at provincial KPU offices, two electoral change management consultants, and two academics specializing in digital public administration.

Qualitative data were collected through semi-structured in-depth interviews using a guide developed from the quantitative findings. Each session lasted 60–90 minutes and was audio-recorded with informant consent. Data were supplemented by non-participant observation during e-voting simulations and analysis of policy documents. Data validation employed source triangulation and method triangulation. Qualitative data analysis used thematic analysis with NVivo 14 software.

4. Empirical Model and Data Analysis

The empirical model is formulated as follows:

$$EMR = \alpha + \beta_1 TI + \beta_2 HRC + \beta_3 LP + \beta_4 (HRC \times CDL) + \beta_5 CMC + \varepsilon$$

Quantitative data analysis proceeded in four sequential stages. First, instrument testing encompassed validity testing via Confirmatory Factor Analysis (CFA) and reliability testing via Cronbach's Alpha

(threshold ≥0.70). Second, classical assumption testing covered normality (Kolmogorov-Smirnov), multicollinearity (VIF<10), heteroscedasticity (Glejser), and autocorrelation (Durbin-Watson). Third, hypothesis testing utilized multiple linear regression with moderation and mediation via Hayes PROCESS macro (Models 4 and 7) (Hayes, 2022). Fourth, overall model testing employed Structural Equation Modeling-Partial Least Squares (SEM-PLS) using SmartPLS 4.

IV. Results and Discussion

1. Results

a. Instrument Testing and Descriptive Statistics

Validity testing via CFA confirmed that all items achieved factor loadings above 0.60 (range: 0.623–0.891), indicating adequate convergent validity. Average Variance Extracted (AVE) values exceeded 0.50 for all constructs, and discriminant validity assessed via the Heterotrait-Monotrait (HTMT) ratio showed values below 0.85 for all construct pairs. All variables met reliability criteria, with Cronbach's Alpha values ranging from 0.78 to 0.92 and Composite Reliability values ranging from 0.83 to 0.95.

Table 2. Reliability and Validity Test Results

Variable	Cronbach's Alpha	Composite Reliability	AVE	Remark
E-Voting Management Readiness (EMR)	0.892	0.923	0.621	Valid & Reliable
Technology Infrastructure (TI)	0.863	0.901	0.588	Valid & Reliable
Human Resource Competency (HRC)	0.845	0.884	0.561	Valid & Reliable
Leadership & Policy (LP)	0.821	0.869	0.574	Valid & Reliable
Comprehensive Digital Literacy (CDL)	0.784	0.843	0.519	Valid & Reliable
Change Management Capacity (CMC)	0.801	0.857	0.543	Valid & Reliable

Respondent descriptive statistics indicate a representative distribution. A total of 68.4% held a bachelor's degree or above, 23.7% held a diploma (D3), and 7.9% had secondary education. Mean years of service was 8.3 years (SD=4.2), with a mean of 5.7 years of information technology use experience. Gender distribution: 54.4% male and 45.6% female. Regional distribution: Java-Bali 38.6%, Sumatra 24.7%, Sulawesi 15.8%, Kalimantan 12.6%, and Eastern Indonesia 8.3%.

b. Quantitative Hypothesis Testing

Multiple regression analysis results show that the overall model is significant ($F(5,209) = 86.43$; $p < 0.001$), with $R^2 = 0.673$ and Adjusted $R^2 = 0.664$, indicating that the five predictor variables collectively explain 67.3% of the variance in e-voting management readiness a substantial figure in social science research. Individual hypothesis test results are presented in Table 3.

Table 3. Summary of Hypothesis Test Results

Hyp.	Variable Relationship	β	t	p-value	R^2	Conclusion
H1	TI → EMR	0.412	7.84	<0.001		Supported ***
H2	HRC → EMR	0.356	6.12	<0.001	0.673	Supported ***
H3	LP → EMR	0.287	4.93	<0.001		Supported ***

H4	HRC×CDL → EMR (Moderation)	0.198	3.47	<0.001		Supported ***
H5	LP → CMC → EMR (Mediation)	0.231	4.18	<0.001		Supported ***

Note: β = Standardized Beta Coefficient; *** p < 0.001; Model fit: CFI = 0.964; RMSEA = 0.048; SRMR = 0.061; AVE > 0.50 for all constructs.

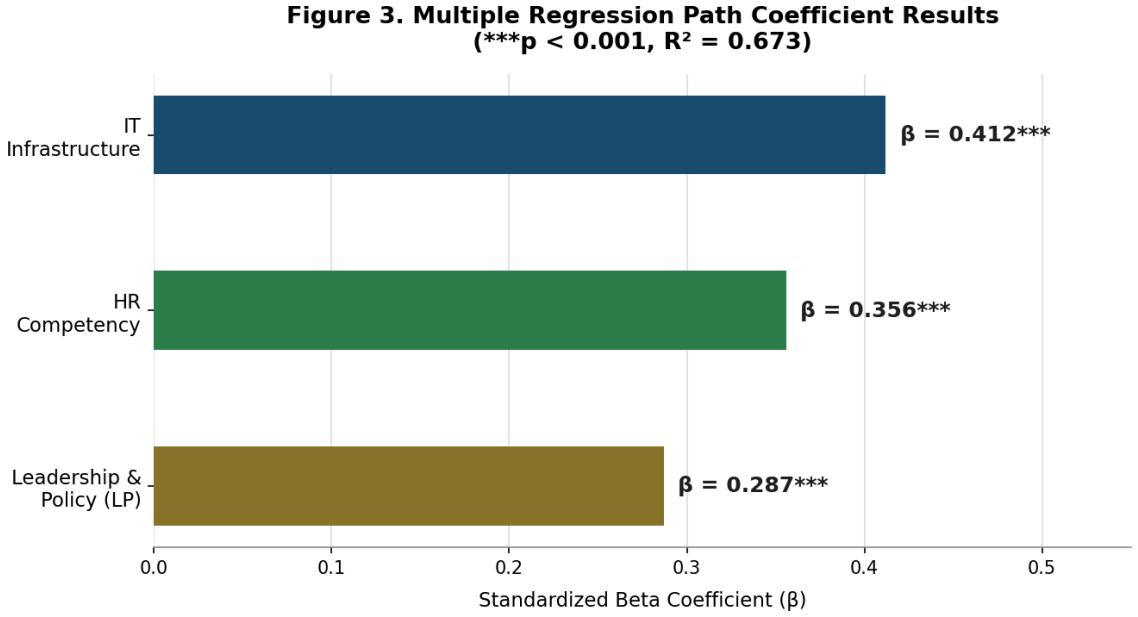


Figure 3. Path Coefficient (Beta) Visualization of Predictor Variables on E-Voting Management Readiness

c. Qualitative Phase Results

Thematic analysis of 12 in-depth interview transcripts yielded three core themes. The first theme, structural institutional resistance, refers to organizational culture barriers and conservative mindsets identified in nine of 12 informants (75%). The second theme, rural-urban digital divide, was raised by all informants from non-Java regions and captures the significant disparity in infrastructure and human resource capacity between urban and rural KPU offices. The third theme, transformational leadership capacity, emerged as the differentiating factor between KPU offices with high and low readiness, where visionary leaders were able to compensate for technical limitations through resource mobilization and the cultivation of an innovative organizational climate.

Table 4. Core Themes, Sub-themes, and Frequency in Qualitative Analysis

Core Theme	Sub-themes	Frequency	Representative Quote
Structural Institutional Resistance	Conservative culture, technology-risk aversion, legacy-system loyalty	9/12 (75%)	"We are more comfortable with the old way that has proven to be free of legal challenges." (Informant KPU-P3)
Rural-Urban Digital Divide	Uneven network infrastructure, limited regional HR, high operational costs	12/12 (100%)	"In our district, the electricity supply is still unreliable — let alone talking about servers for e-voting." (Informant KPU-K7)
Transformational Leadership Capacity	Digitalization vision, resource mobilization, innovation climate building	8/12 (67%)	"Our leader is the one who pushes us to learn new technology, even with a limited budget." (Informant KPU-P1)

2. Discussion

The finding that technology infrastructure is the strongest predictor of e-voting management

readiness (β=0.412; p<0.001) confirms and extends TAM's proposition that perceived ease of use and perceived usefulness are significantly influenced by the quality of available technology systems (Davis, 1989). In the context of digital industrial convergence, this finding implies that investment in electoral technology infrastructure must be treated on a par with investment in strategic national industrial infrastructure. This is consistent with Dynamic Capability Theory, which emphasizes the importance of a strong asset base as the foundation for dynamic capabilities (Teece et al., 1997). The convergence of this quantitative finding with informants' narratives on regional infrastructure limitations provides cross-validation that strengthens the reliability of the overall results.

The significant effect of human resource competency (β=0.356; p<0.001) confirms the role of change agents in DOI (Rogers, 2003). The study's novelty lies in the discovery of the moderating effect of comprehensive digital literacy (H4 supported; β=0.198; p<0.001), which demonstrates that the relationship between technical competency and e-voting readiness is significantly amplified when individuals simultaneously exhibit digital literacy across cognitive, affective, and conative dimensions. This finding surpasses the work of Schaupp and Carter (2005), which considered only unidimensional technical competency, by revealing that digital critical thinking capacity and a positive affective disposition toward innovation are equally important prerequisites. Qualitative confirmation via the institutional resistance theme clarifies that low digital literacy is not merely a technical skills problem, but also a psychological and cultural readiness challenge.

The discovery of the mediating effect of change management capacity on the relationship between policy leadership and e-voting readiness (H5 supported; indirect effect=0.231; p<0.001) represents the most significant theoretical contribution of this study. This finding fills a gap in the literature, which has long treated leadership and organizational readiness as a direct relationship without accounting for the underlying transmission mechanism (Moynihan, 2004). Effective transformational leadership as attested by 67% of informants operates through the construction of organizational change management capacity, serving as the bridge between a leader's strategic vision and the team's operational readiness. The integration of quantitative and qualitative evidence produces a causal understanding that neither approach could achieve independently.

The cross-finding implications from both phases indicate that e-voting management readiness is multidimensional and cannot be achieved through partial interventions. Institutions that invest only in infrastructure without developing human resources and leadership will encounter bottlenecks at the implementation stage. Conversely, highly competent personnel without adequate infrastructure support will experience technical frustration that impedes adoption. These findings directly support the central proposition of the IEVMR Model that e-voting readiness is a function of the synergistic interaction among the three primary determinants, not a linear aggregation of each component in isolation.

V. Conclusion

This study successfully examined e-voting management readiness through comprehensive mixed methods approach that integrates the inferential power of quantitative statistical analysis with the interpretive depth of qualitative inquiry. Technology infrastructure readiness, human resource competency, and policy leadership collectively explain 67.3% of the variance in e-voting management readiness, with technology infrastructure functioning as the dominant predictor. Two previously unidentified transmission mechanisms were also uncovered: the moderating effect of Comprehensive Digital Literacy on the human resource competency e- voting readiness pathway, and the mediating effect of Change Management Capacity on the policy leadership e-voting readiness pathway.

The study's novelty operates at three levels. At the theoretical level, the IEVMR Model represents the first predictive framework to cohesively integrate TAM, Diffusion of Innovation Theory, and Dynamic Capability Theory for the context of digital electoral innovation management, surpassing the single-theory approaches that dominate the prior literature. At the empirical level, the two newly identified transmission mechanisms expand understanding of the causal architecture of e-voting readiness in ways that monomethod approaches cannot achieve. At the methodological level, this study constitutes

the first to apply an explanatory sequential mixed methods design systematically to e-voting research in Indonesia, producing a replicable procedure that future researchers can build upon.

The study's contribution is directly relevant to the industrialization agenda as a component of global economic resilience. Digitalization of the electoral system as the downstream product of the national digital technology industry value chain demands a robust management foundation and the findings of this study provide an evidence-based diagnostic framework that electoral institutions can operationalize to measure and continuously improve their e-voting adoption readiness. Three principal practical implications follow: the establishment of national minimum technology infrastructure standards for elections with budget allocations that account for regional disparities; the development of a Certified Digital Electoral Officer program that integrates technical competency with comprehensive digital literacy; and the building of transformational leadership capacity at all KPU levels through mentoring-based learning organization programs.

This study is subject to several limitations that warrant acknowledgment. Author Action Required: Insert 2–3 sentences on specific limitations, e.g., cross-sectional design limits causal inference over time; sampling did not cover all provinces equally; online survey instruments are susceptible to social desirability bias. Future research should test the IEVMR Model longitudinally and extend its application to local electoral contexts, as well as to cross-national comparisons within ASEAN member states exhibiting varying levels of digital industrialization.

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