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Digital Governance Transformation in Regional Government: A Multi-Dimensional Framework for Enhancing Public Service Delivery in Central Kalimantan Province, Indonesia

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Abstract

This study systematically analyzes digital governance implementation in Central Kalimantan Province, Indonesia, identifying multidimensional challenges and developing a recontextualized framework that extends foundational e-government models to address contemporary requirements for system integration and multi-stakeholder coordination. Employing a qualitative case study approach, data were collected through in-depth semi-structured interviews with 27 key informants (provincial officials, ICT administrators, district-level managers, and civil society representatives), document analysis of policy frameworks and SPBE evaluation reports (2018-2024), and direct observation of digital government platforms. Indrajit's (2002) six-dimensional e-government model provided the analytical framework, operationalized through systematic coding and thematic analysis. Findings reveal that despite substantial digital adoption progress with over 200 applications implemented and 79.5% internet penetration, Central Kalimantan's digital governance confronts critical systemic deficits. Assessment across six dimensions shows: (1) content development exhibits application proliferation without integration, with 40% of systems experiencing significant downtime; (2) competency building is severely constrained by acute ICT professional scarcity (0.3% of civil servants); (3) connectivity faces extreme geographical disparities with 186 villages remaining as "blank spots"; (4) cyber laws demonstrate substantial implementation gaps, with only 35% of systems implementing mandated security protocols; (5) citizen interfaces experience fragmentation with unintegrated service channels; and (6) capital allocation remains insufficient at 1.2% of provincial budget. Cross-dimensional analysis identifies three fundamental structural deficits: system fragmentation and absence of interoperability standards, inadequate coordination mechanisms lacking enforcement authority, and sustainability vulnerabilities reflecting insufficient lifecycle planning and vendor dependency. The study develops the C7I Model (Content, Competency, Connectivity, Cyber Laws, Citizen Interfaces, Capital, Interoperability, and Coordination-Collaboration), a comprehensive framework that explicitly integrates interoperability and coordination-collaboration as distinct analytical dimensions alongside Indrajit's original six components. Structured in three interconnected layers (foundational enablers, operational capabilities, and integrative mechanisms), the model addresses contemporary realities of fragmented digital ecosystems in regional government contexts.

Keywords: *Digital governance; e-government; interoperability; regional government; digital transformation; Indonesia; coordination mechanisms; system integration; SPBE; C7I Model.*

Introduction

The global trajectory of public sector modernization has been fundamentally reshaped by digital transformation initiatives, positioning digital governance as a critical enabler of transparent, efficient, and accountable public administration (Erkut, 2020; Margetts & Dunleavy, 2013). Across diverse national contexts, governments have increasingly leveraged information and communication technologies (ICT) to reimagine service delivery models, enhance citizen engagement, and optimize institutional performance (Gil-Garcia et al., 2014). This digital imperative has become particularly pronounced in developing economies, where e-government initiatives promise to leapfrog traditional

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bureaucratic constraints and address persistent governance deficits (Asgarkhani, 2007; Heeks & Bailur, 2007).

Indonesia's commitment to digital government transformation is formally articulated through Presidential Regulation No. 95 of 2018 on Electronic-Based Government Systems (SPBE), which mandates the integration of digital platforms across all levels of government to achieve efficient, transparent, and participatory governance. This regulatory framework reflects a broader national recognition that digitalization represents not merely a technological upgrade, but a fundamental reconfiguration of state-citizen relationships and administrative processes (Indrajit, 2002). However, the translation of this national vision into operational reality at the regional level confronts substantial structural, institutional, and contextual challenges that remain inadequately theorized in existing literature.

Central Kalimantan Province exemplifies these implementation complexities. Despite positive trends in digital adoption with internet penetration reaching 79.5% nationally in 2024 (APJII, 2024)—the province's Digital Society Index (IMDI) score of 41.09 in 2024 positions it in the "moderate" category, significantly below the national average and substantially lagging behind digitally mature provinces. More critically, the province exhibits stark internal disparities: while the dimension of "digital skills" scores 54.30, indicating reasonable technical competence among users, the "empowerment" dimension registers only 25.41, revealing a fundamental disconnect between digital access and productive utilization (Kementerian Komunikasi dan Digital, 2024). This gap underscores a critical governance challenge: digital infrastructure and literacy alone are insufficient to generate meaningful public value without systemic integration, institutional capacity, and strategic coordination.

The province's geographical characteristics further compound these challenges. Spanning 153,564 square kilometers of predominantly forested and riverine terrain, Central Kalimantan encompasses extensive remote areas where basic infrastructure—electricity grids and telecommunications networks remains inadequate or absent entirely (Arrazi, 2022). As of 2024, hundreds of villages remained classified as "blank spots" with no reliable internet connectivity, while others depend on nascent satellite-based solutions requiring renewable energy sources (Oktobrian et al., 2025). These infrastructural constraints directly limit the reach and effectiveness of digital government services, creating a pronounced urban-rural digital divide that threatens to exacerbate existing socioeconomic inequalities rather than ameliorate them.

Beyond infrastructure, Central Kalimantan's digital governance landscape is characterized by significant organizational and systemic fragmentation. Evaluation data indicates that while over 200 digital applications have been developed across various regional government agencies, these systems operate largely in isolation creating data silos, redundant processes, and inefficient resource allocation (Riswati, 2021). The absence of robust interoperability standards and coordinated governance mechanisms undermines the potential for integrated service delivery and cross-institutional data sharing, limiting both administrative efficiency and citizen-centric service design. Furthermore, persistent gaps in digital competency among civil servants, coupled with limited budgetary allocations for ICT capacity building and system maintenance, constrain the sustainability and scalability of digitalization efforts (Rachmatullah & Purwani, 2022).

Existing theoretical frameworks for e-government implementation, while foundational, exhibit important limitations when applied to contexts characterized by pronounced infrastructure deficits, institutional fragmentation, and geographical complexity. Indrajit's (2002) six-dimensional model—encompassing content development, competency building, connectivity, cyber laws, citizen interfaces, and capital—provides a comprehensive analytical lens for assessing e-government maturity. However, this framework was developed prior to the contemporary emphasis on system interoperability and multi-stakeholder coordination that has become central to digital governance discourse (Chatfield & AlAnazi, 2015; Scholl & Klischewski, 2007). Similarly, stage-based maturity models (Layne & Lee, 2001) tend to assume linear progression and relatively uniform enabling conditions that do not adequately account for the heterogeneous, resource-constrained environments typical of Indonesian regional governments.

This study addresses these conceptual and empirical gaps through three principal objectives. First, it systematically analyzes the current state of digital government implementation in Central Kalimantan Province using Indrajit's (2002) framework as an analytical foundation, providing empirical insights into the multidimensional challenges confronting regional digitalization efforts. Second, it identifies and examines the structural, institutional, and contextual factors that enable or constrain effective digital governance in this setting. Third, and most significantly, it develops and proposes the C7I Model—a

recontextualized framework that extends Indrajit's original dimensions by explicitly incorporating interoperability and coordination-collaboration as essential components of sustainable digital governance. This model responds directly to contemporary challenges of system integration and multi-level governance coordination identified in recent literature (Pribadi et al., 2024; Meijer & Bekkers, 2015).

The study's contributions are both theoretical and practical. Theoretically, it advances digital governance scholarship by demonstrating how foundational e-government frameworks can be adapted and extended to address contemporary challenges in complex, resource-constrained contexts. The explicit theorization of interoperability and coordination as distinct analytical dimensions represents a conceptual innovation responsive to the realities of fragmented digital ecosystems documented across developing regions (Dawes, 2008; Luna-Reyes & Gil-Garcia, 2014). Practically, the C7I Model provides regional policymakers and practitioners with a contextually grounded framework for diagnosing implementation challenges, prioritizing interventions, and designing integrated digital governance strategies that account for both technical and institutional requirements.

Research Methodology

This study employs a qualitative case study approach to investigate digital governance implementation in Central Kalimantan Province. The case study method proves appropriate for examining complex, context-dependent phenomena where boundaries between phenomenon and context are not clearly evident (Creswell, 2012; Yin, 2003). Central Kalimantan represents a critical case for understanding regional digital governance challenges in Indonesia, exhibiting characteristics common across outer island provinces, geographical dispersion, infrastructure constraints, and limited institutional capacity while maintaining sufficient scale and administrative sophistication to provide meaningful insights for comparable contexts.

Research Setting. Central Kalimantan spans 153,564 square kilometers across 13 districts and one municipality, with significant territorial heterogeneity ranging from relatively developed urban centers to remote riverine communities. This geographical complexity, combined with moderate digital maturity (IMDI score 41.09 in 2024), positions the province as neither an exemplary leader nor an extreme laggard in digitalization efforts, enhancing the transferability of findings to similar regional contexts (Kementerian Komunikasi dan Digital, 2024).

Data Collection. Data were collected through three complementary methods ensuring triangulation and comprehensiveness (Denzin & Lincoln, 2011). First, in-depth semi-structured interviews were conducted with 27 key informants purposively selected to represent diverse stakeholder perspectives: provincial government officials responsible for ICT policy and implementation, heads of technical departments (Dinas Komunikasi, Informatika, Persandian, dan Statistik), district-level administrators, civil servants utilizing digital systems, and civil society representatives engaged in digital literacy initiatives. Interviews averaged 75 minutes, were conducted in Indonesian, audio-recorded with consent, and transcribed verbatim.

Second, document analysis examined policy documents (Provincial Regulation No. 3 of 2016, Governor Regulation No. 24 of 2022), SPBE evaluation reports (2018-2024), strategic plans, application inventories, budget allocations, and implementation guidelines. These documents provided objective data on formal frameworks, resource commitments, and official assessments of digital governance performance. Third, direct observation of digital government platforms—websites, service portals, mobile applications assessed functionality, usability, and integration levels, complementing interview and document data with first-hand system evaluation.

Analytical Framework. Indrajit's (2002) six-dimensional e-government model provided the primary analytical lens, operationalized through deductive coding of interview transcripts and documents according to: (1) content development applications, services, and digital content; (2) competency building human resource capacity and training; (3) connectivity infrastructure and network availability; (4) cyber laws regulatory frameworks and legal compliance; (5) citizen interfaces service channels and engagement mechanisms; (6) capital financial resources and sustainability. This structured analysis enabled systematic assessment across dimensions while remaining open to emergent themes through inductive coding of data segments not fitting predetermined categories (Creswell, 2012).

Data analysis followed Miles and Huberman's iterative process: data condensation through coding and categorization, data display via matrices organizing findings by dimension and stakeholder perspective, and conclusion drawing through pattern identification and theoretical interpretation

(Moleong, 2009). NVivo software facilitated coding consistency and retrieval. Analytical rigor was enhanced through investigator triangulation, multiple researchers independently coded subsets of data with subsequent comparison and consensus-building, and member checking whereby preliminary findings were presented to key informants for validation and refinement (Sugiyono, 2019).

Validity and Reliability. Credibility was established through prolonged engagement (data collection spanning six months), persistent observation of digital systems, and triangulation across data sources and methods. Transferability was enhanced through thick description of context, enabling readers to assess applicability to other settings. Dependability was ensured via detailed documentation of methodological decisions, coding procedures, and analytical processes, creating an audit trail for external review. Confirmability was pursued through reflexive journaling, making the researcher's assumptions and interpretations explicit for critical examination.

Ethical Considerations. Research protocols received approval from the institutional review board. Informed consent was obtained from all interview participants, with assurances of confidentiality and voluntary participation. Identifying information has been removed from all quotations and descriptions to protect participant anonymity while preserving substantive content.

Result And Discussion

This section presents empirical findings organized according to Indrajit's (2002) six-dimensional framework, followed by cross-dimensional analysis revealing systemic integration challenges that inform the C7I Model development. Findings draw on interview data, document analysis, and system observations to provide a comprehensive assessment of digital governance implementation in Central Kalimantan Province.

Content Development: Applications and Digital Services

Central Kalimantan has experienced substantial growth in digital applications and services, with over 200 applications deployed across provincial and district agencies by 2024. Key systems include the Regional Financial Information System (SIPKD), Employee Management System (SIMPEG), Regional Asset Management System (SIMBADA), and various sector-specific platforms for education, health, and public works management. This proliferation demonstrates a significant commitment to digitalization and represents meaningful progress from minimal digital presence in 2015.

However, quantity does not equate to quality or integration. System reliability assessments reveal critical weaknesses. A senior official from Dinas Komunikasi, Informatika, Persandian, dan Statistik stated: "We have many applications, but frequent downtime frustrates users. Some systems crash during peak usage periods, forcing staff to revert to manual processes. This undermines confidence and creates resistance to digital adoption." Technical documentation confirms that 40% of provincial applications experienced significant downtime (>4 hours monthly) during 2023, with root causes including inadequate server capacity, insufficient technical support, and lack of regular maintenance protocols.

User interface design presents another substantial barrier. Observational analysis of 15 major government portals using Nielsen's usability heuristics revealed consistent problems: non-intuitive navigation structures, inconsistent terminology across related services, absence of search functionality, and lack of mobile optimization despite 87% of provincial internet users accessing services via smartphones (APJII, 2024). A district government administrator noted: "Citizens complain that completing one service request requires navigating multiple disconnected systems with separate logins. We lose users at each transition point." This fragmented user experience directly contradicts digital governance principles emphasizing seamless, citizen-centric service delivery (Bertot & Jaeger, 2006).

Content quality and currency vary dramatically across agencies. Well-resourced departments maintain updated information and functional services, while smaller agencies operate outdated websites with broken links and obsolete content. Document analysis of 25 district government websites found that 60% contained information not updated within six months, violating Provincial Regulation No. 5 of 2013 on Public Information Services, which requires quarterly updates. This inconsistency reflects capacity disparities and the absence of enforced content management standards.

The One Data Portal (satudata.kalteng.go.id), established pursuant to Presidential Regulation No. 39 of 2019, represents a promising integration initiative. The portal consolidates datasets from multiple agencies, providing centralized access to development indicators, budget information, and sectoral statistics. However, implementation faces challenges. An informant from the Provincial Planning

Agency explained: *"Data quality varies significantly. Some agencies submit incomplete or outdated data because they lack staff trained in data management. We have the platform but struggle with consistent, quality content."* Analysis confirms that only 65% of mandated datasets were current as of December 2024, with particularly weak compliance from district governments and smaller provincial agencies.

Service digitalization remains concentrated in administrative processes rather than in transformative service redesign. Most applications automate existing bureaucratic procedures without reimagining workflows for digital environments. This "paving the cow path" approach, digitizing inefficient processes rather than reengineering them, limits efficiency gains and perpetuates citizen frustration (Dunleavy et al., 2006). A civil society representative observed: *"Online permit applications still require the same documents and approvals as manual processes, just submitted digitally. Citizens see little benefit beyond avoiding physical queues."*

Competency Building: Human Resource Capacity

Human resource capacity represents perhaps the most critical constraint on digital governance advancement. Central Kalimantan faces acute shortages of ICT professionals, with only 147 civil servants holding formal ICT qualifications among approximately 45,000 provincial and district employees. This 0.3% ratio falls dramatically below the 2% minimum recommended by national SPBE guidelines. The Head of Human Resources Development Agency stated, *"We cannot compete with private sector salaries for skilled ICT professionals. Recruitment regulations restrict hiring specialists without civil service examinations, which few ICT experts pursue, given better private opportunities."*

Existing ICT staff concentrate in the provincial capital, Palangka Raya, leaving district governments severely under-resourced. Six of the 13 districts reported having fewer than three dedicated ICT personnel responsible for all digital systems, ranging from infrastructure maintenance to application development and user support. This concentration creates dependency relationships where districts must request provincial assistance for routine troubleshooting, causing delays and reinforcing centralization contrary to decentralization principles.

Training initiatives, while increasing, remain insufficient in scope and effectiveness. The Provincial Civil Service Training Agency conducted 12 digital literacy programs during 2023-2024, training approximately 800 employees, less than 2% of the workforce. Training focuses predominantly on basic computer skills and standard office applications rather than specialized competencies required for digital governance: data analytics, cybersecurity, system integration, or user experience design. A training participant noted: *"The training taught us to use Microsoft Office, which most of us already know. We need training on the specific government systems we use daily, but that's not offered."*

Leadership digital competency gaps compound technical skill deficits. Senior administrators, many of whom began careers before widespread digitalization, often lack the understanding necessary to champion transformation, evaluate vendor proposals, or make strategic technology decisions. An informant from the Governor's Office observed: *"Leaders support digitalization in principle but struggle to translate this into concrete priorities and resource allocations. Without leadership understanding, digital initiatives remain peripheral rather than central to organizational strategy."* This finding aligns with research emphasizing digital leadership as critical for organizational transformation (Khan et al., 2024).

Budget constraints severely limit capacity-building investments. Analysis of 2023 provincial budget allocations reveals that only 0.8% of total expenditure supported ICT training, far below the amounts needed for comprehensive workforce development. Short-term budget cycles prevent sustained multi-year training programs necessary for building and maintaining sophisticated digital competencies. A finance official explained: *"Training budgets are often cut when we face fiscal pressures because they're seen as non-essential compared to direct service delivery."*

Vendor dependency emerges as a problematic consequence of capacity deficits. Unable to develop or maintain systems internally, agencies rely heavily on external contractors, creating sustainability risks and knowledge transfer failures. Multiple informants reported that when vendor contracts end, systems become unmaintainable because internal staff lack technical documentation and skills to continue operations. This dependency undermines long-term sustainability and increases life-cycle costs (Gil-García & Pardo, 2005).

Connectivity: Infrastructure and Network Access

Infrastructure development has accelerated substantially during 2020-2024, yet profound disparities persist between urban centers and remote areas. Palangka Raya and major district capitals enjoy reliable 4G coverage and fiber-optic connectivity, enabling sophisticated digital services. In contrast, 186 villages across the province remained classified as "blank spots" with no cellular coverage as of early 2024, while hundreds more receive only intermittent 2G/3G signals insufficient for data-intensive applications.

Geographical challenges fundamentally constrain infrastructure deployment. Central Kalimantan's riverine topography, extensive forests, and dispersed settlement patterns make conventional tower-based network expansion economically unviable in many areas. Road accessibility limitations further complicate infrastructure projects; some villages remain reachable only by river transport, dramatically increasing installation and maintenance costs. A telecommunications company representative stated: *"The business case for tower construction disappears in villages with 200-300 residents located days from the nearest road. Government subsidies are necessary but insufficient to close the economic gap."*

Innovative solutions are emerging but remain limited in scale. The provincial government's partnership with Starlink to provide satellite internet to 50 remote villages, supported by solar panel installations, represents significant progress toward universal connectivity. Early implementation results are promising, with download speeds averaging 50-100 Mbps, enabling video conferencing and data-intensive applications previously impossible. However, high subscription costs (approximately IDR 1,000,000 monthly per installation) and dependence on continuous government subsidies raise sustainability questions. A district administrator noted, *"Starlink solves the technical challenge but creates fiscal dependency. If subsidies end, villages cannot afford continued service."*

Electricity access constitutes a fundamental prerequisite for connectivity that remains unmet in significant areas. Approximately 15% of provincial households lack grid electricity, relying on diesel generators or having no power supply. Digital devices and network equipment cannot function without reliable electricity, rendering connectivity investments ineffective in these contexts. The Provincial Energy Agency is expanding solar microgrids, but progress remains slow due to capital requirements and technical complexity.

Bandwidth quality varies dramatically across connected areas. While urban centers enjoy adequate capacity, many district facilities struggle with congested networks and unreliable connections. Schools and health centers often operate with shared consumer-grade connections inadequate for institutional needs. A health center director explained: *"Our telemedicine system requires video consultations, but our connection frequently fails mid-consultation. Doctors and patients become frustrated, undermining trust in digital health services."*

Government facility prioritization remains inconsistent. Some districts systematically ensure connectivity for all government offices, schools, and health facilities, while others focus exclusively on administrative centers. This variation reflects differing leadership priorities and technical capacity rather than deliberate policy, resulting in arbitrary inequalities in digital service access.

Cyber Laws: Regulatory Frameworks

Central Kalimantan has established a comprehensive regulatory foundation for digital governance, including Provincial Regulation No. 3 of 2016 on ICT Master Planning and SPBE, and Governor Regulation No. 24 of 2022 on SPBE Implementation. These regulations align with national frameworks, Presidential Regulation No. 95 of 2018 on SPBE, Law No. 11 of 2008 on Electronic Information and Transactions, and Law No. 14 of 2008 on Public Information Openness—creating a formal legal basis for digitalization initiatives.

However, regulatory comprehensiveness does not guarantee implementation effectiveness. Interview data reveal significant gaps between formal regulations and operational practice. Information security provisions in Governor Regulation No. 24 of 2022 mandate encryption for sensitive data, multi-factor authentication for system access, and regular security audits. Yet security assessments conducted by the Provincial Inspectorate in 2023 found that only 35% of government systems implemented encryption, 20% employed multi-factor authentication, and comprehensive security audits had not occurred since 2020. A cybersecurity officer stated: *"Regulations exist, but agencies lack the technical capacity and budget to comply. There are no consequences for non-compliance, so implementation remains voluntary in practice."*

Personal data protection represents a critical vulnerability. Despite Indonesia's adoption of Law No. 27 of 2022 on Personal Data Protection, provincial implementing regulations remain underdeveloped. Many government applications collect extensive personal information identification numbers, financial data, and health records, without clear data minimization principles, security standards, or citizen consent mechanisms. Document review of 20 government applications found that only 4 included privacy policies, and none provided users with data access, correction, or deletion capabilities mandated by the national law.

Digital signature and electronic document authentication pose ongoing challenges. While national regulations establish legal validity for electronic signatures, implementation infrastructure remains incomplete. Government agencies lack consistent standards for electronic document formats, authentication protocols, or archival procedures. This ambiguity forces many processes to maintain parallel paper-based workflows "for legal certainty," undermining efficiency objectives. A legal affairs official explained: *"Courts still prefer physical documents with wet signatures. Until judicial practice fully accepts electronic documents, we must maintain dual systems."*

Interagency data sharing faces legal ambiguities. While the One Data policy encourages data sharing for policy coordination, sectoral laws containing confidentiality provisions create uncertainty about permissible sharing. Health, education, and social welfare agencies cite legal restrictions preventing data integration, even when such integration could improve service coordination. Absent clear legal frameworks reconciling sectoral confidentiality with integration objectives, agencies default to restrictive interpretations limiting data sharing (Scholl & Klischewski, 2007).

Regulatory enforcement mechanisms remain weak. Provincial regulations assign monitoring responsibilities to the SPBE Coordination Team, but this body lacks investigative authority, enforcement powers, or dedicated resources. Compliance reporting is voluntary and inconsistent. The absence of consequences for non-compliance reduces regulatory frameworks to aspirational guidelines rather than binding requirements, substantially limiting their governance impact.

Citizen Interfaces: Service Channels and Engagement

Digital citizen engagement channels have expanded significantly, but remain limited in scope and integration. The provincial government maintains an active social media presence across platforms—Facebook, Instagram, Twitter, and YouTube, with regular content updates and increasing follower engagement. The official website (kalteng.go.id) provides information access and limited transactional services. Individual agencies operate separate portals for sector-specific services: education enrollment, health services, business licensing, and complaint submission.

However, channel proliferation creates fragmentation rather than integration. Citizens must navigate multiple unconnected platforms to access different services, each requiring separate registration and authentication. No single sign-on system exists, forcing users to create and manage numerous credentials. Observational analysis confirmed that completing a business license application required accessing four separate systems with distinct interfaces and data entry requirements. This fragmentation directly violates user-centered design principles emphasizing seamless, integrated experiences (Bertot & Jaeger, 2006).

The SP4N-LAPOR! complaint management system, a national platform integrated at the provincial level, represents the most developed citizen engagement mechanism. Citizens can submit complaints via the website or mobile application, with automated routing to responsible agencies and public visibility of response status. Analysis of SP4N-LAPOR! Data from 2023 reveals 3,847 complaints submitted, with 72% receiving agency responses within mandated timeframes. However, qualitative analysis of responses indicates many constitute acknowledgment rather than substantive resolution. A civil society representative stated: *"Agencies respond to meet performance metrics but often provide bureaucratic explanations rather than solving problems. Citizens become cynical about the system's effectiveness."*

Social media engagement exhibits similar patterns of activity without meaningful interaction. While agencies post frequently, analysis of comment responses shows limited genuine dialogue. Citizen questions and concerns often go unanswered or receive generic responses not address specific issues. This one-way communication pattern fails to realize social media's potential for authentic government-citizen engagement and co-creation of public value (Bertot et al., 2010).

Digital divide effects concentrate among elderly populations, rural residents, and lower-income groups. Survey data from the Provincial Statistics Agency indicates that while 68% of urban residents aged 25-45 have used government digital services, only 23% of rural residents and 12% of residents

over 60 have done so. This disparity reflects both infrastructure limitations and digital literacy gaps, creating two-tiered service access, contradicting equity objectives. A district health official noted: *"Our digital immunization tracking system works well for urban, educated mothers but excludes the most vulnerable populations in remote areas who most need health services."*

Participatory planning mechanisms remain largely conventional despite digital tools' potential for enhancing participation. The Provincial Planning Agency conducts development planning consultations (Musrenbang) through traditional face-to-face meetings rather than leveraging online platforms for broader, more inclusive participation. When questioned, a planning official explained: *"We tried online consultations during COVID-19, but participation was low and dominated by activists in Palangka Raya. Rural communities lack connectivity and digital literacy to participate meaningfully online."* This experience highlights that digital participation requires not only platforms but also capacity building and deliberate inclusion strategies (Ansell & Gash, 2008).

Capital: Financial Resources and Sustainability

Financial constraints represent a pervasive limitation across all digitalization dimensions. Total provincial ICT expenditure in 2023 amounted to IDR 127 billion (approximately USD 8.5 million), constituting 1.2% of the total provincial budget. This proportion falls significantly below the 3-5% recommended by national SPBE guidelines and substantially below levels in more digitally mature provinces. Budget analysis reveals that 68% of ICT expenditure supports routine operations, internet subscriptions, device procurement, and basic maintenance, leaving only 32% for development initiatives such as new applications, infrastructure expansion, or capacity building.

Short-term budget cycles fundamentally constrain strategic investment. Indonesia's annual budgeting system requires all expenditures to receive yearly appropriation, preventing multi-year commitments essential for infrastructure projects, system development, or sustained training programs. A budget official explained: *"We cannot plan three-year system development projects because funding must be re-approved annually. Political and fiscal conditions change, creating uncertainty that vendors factor into pricing or causing project abandonment mid-implementation."* This structural constraint inhibits the long-term investments necessary for digital transformation.

Application development and maintenance costs concentrate on initial development while under-resourcing ongoing operations. Agencies allocate budgets for building new systems but fail to sustain them through adequate maintenance, security updates, or user support. This pattern creates expanding portfolios of deteriorating applications. The Head of Dinas Komunikasi stated: *"We have applications developed five years ago that barely function because we cannot afford maintenance contracts. Rather than fixing them, agencies request new applications, compounding our technical debt."* This lifecycle cost blindness reflects both budgetary constraints and governance failures in total cost of ownership planning (Gil-García & Pardo, 2005).

Dependency on national transfers limits provincial fiscal autonomy for digitalization. Central Kalimantan receives approximately 75% of revenue from central government transfers, with most designated for specific purposes (education, health, infrastructure). Discretionary funds available for ICT investments remain limited, and digitalization competes with numerous alternative priorities. District governments face even greater fiscal constraints, with many unable to allocate any discretionary funding for digital initiatives beyond nationally mandated systems.

Public-private partnerships have been explored but remain limited. The Starlink satellite internet initiative represents a successful partnership between the provincial government, telecommunications companies, and infrastructure providers. However, most potential private partners cite insufficient user populations and uncertain government procurement processes as barriers to investment. Regulatory restrictions on foreign ownership in telecommunications and technology sectors further limit partnership possibilities.

Cost-benefit analysis and return-on-investment calculations are rarely conducted for digital investments. Agencies justify ICT expenditures based on compliance with national mandates or general efficiency claims rather than rigorous analysis of expected benefits, implementation costs, and alternative options. This analytical deficit contributes to suboptimal resource allocation and undermines evidence-based decision-making. A legislative oversight committee member noted: *"Agencies request ICT budgets with vague justifications about 'modernization' and 'efficiency.' We lack tools to evaluate whether proposed investments represent good value for money."*

The C7i Model: A Recontextualized Framework for Digital Governance

Rationale for Model Development

The empirical findings reveal that Central Kalimantan's digital governance challenges extend beyond the six dimensions captured in Indrajit's (2002) framework. While content, competency, connectivity, cyber laws, citizen interfaces, and capital remain essential analytical categories, two critical governance requirements emerge as inadequately theorized: interoperability and coordination-collaboration. The fragmented application ecosystem, data silos, disconnected service channels, and weak inter-agency alignment documented in Section 4 demonstrate that technical and organizational integration constitute not peripheral concerns but fundamental prerequisites for effective digital governance (Scholl & Klischewski, 2007; Chatfield & AlAnazi, 2015).

Contemporary digital governance scholarship increasingly recognizes interoperability and coordination as distinct analytical domains requiring explicit theoretical attention (Dawes, 2008; Luna-Reyes & Gil-Garcia, 2014). However, existing e-government frameworks developed in earlier technological contexts often subsume these dimensions within broader categories or treat them as implementation details rather than strategic imperatives. The C7I Model addresses this gap by elevating interoperability and coordination-collaboration to equal status with Indrajit's original dimensions, creating a comprehensive framework aligned with both contemporary theoretical insights and empirical realities of regional digital governance in Indonesia.

Model Architecture and Components

The C7I Model comprises eight integrated dimensions organized into three interconnected layers: foundational enablers, operational capabilities, and integrative mechanisms (Figure 1).

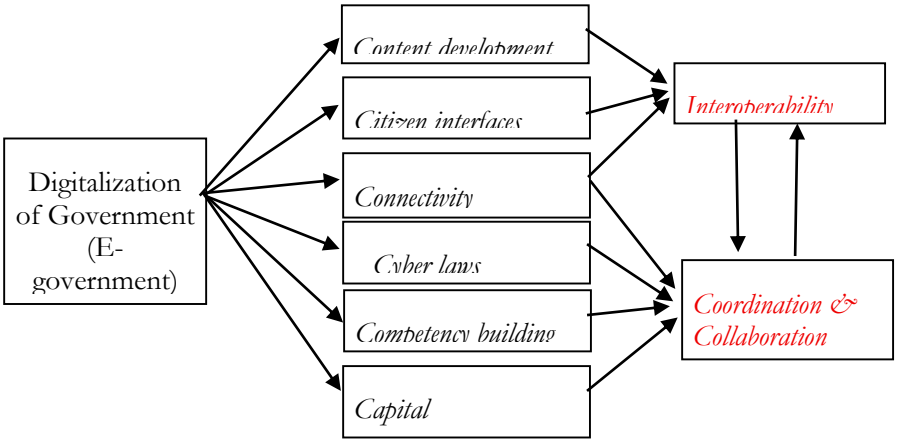

Figure 1 Government Digitalization Model (Model C7I)

Layer 1: Foundational Enablers establish basic prerequisites for digital governance:

1) Connectivity provides physical and digital infrastructure enabling system access
2) Capital ensures financial resources for development, operation, and maintenance
3) Cyber Laws establish regulatory frameworks governing digital operations

Layer 2: Operational Capabilities translates foundational enablers into functional systems:

1) Content Development creates applications, services, and digital information
2) Competency Building develops human resource capacities for system operation and innovation
3) Citizen Interfaces establish channels for service delivery and engagement

Layer 3: Integrative Mechanisms ensure coherence and sustainability across operational capabilities:

1) Interoperability enables technical, semantic, organizational, and legal integration across systems and agencies
2) Coordination and Collaboration establish governance structures and processes for multi-stakeholder alignment

This layered architecture reflects logical dependencies while recognizing reciprocal relationships. Foundational enablers condition but do not determine operational capabilities; strong connectivity, adequate funding, and clear regulations remain insufficient without competent personnel and quality content. Similarly, operational capabilities require integrative mechanisms to achieve systemic effectiveness; multiple applications and skilled staff produce fragmented outcomes without interoperability standards and coordination protocols.

Interoperability Dimension encompasses four interrelated levels adapted from Scholl and Klischewski (2007):

1) *Technical Interoperability:* System-to-system data exchange capabilities through standardized APIs, common data formats (XML, JSON), integration middleware, and unified authentication protocols. In the Central Kalimantan context, this requires establishing provincial ICT architecture standards, mandating API development for all government applications, and implementing enterprise service bus infrastructure enabling real-time data sharing
2) *Semantic Interoperability:* Shared data definitions, common ontologies, and standardized metadata enabling consistent interpretation across organizational contexts. Implementation necessitates developing provincial data dictionaries defining core concepts (citizen, household, business entity), establishing sector-specific data standards (health records, education credentials, land parcels), and creating governance mechanisms for maintaining definitional consistency as requirements evolve.
3) *Organizational Interoperability:* Aligned business processes, collaborative workflows, and coordinated service delivery models transcending agency boundaries. This requires process reengineering to eliminate redundant data collection, designing cross-agency workflows for integrated services (e.g., combined business licensing), and establishing performance metrics incentivizing collaboration rather than individual agency optimization.
4) *Legal Interoperability:* Compatible regulatory frameworks, harmonized data sharing agreements, and consistent privacy and security standards enabling lawful integration. Implementation involves developing provincial data sharing regulations, creating standard inter-agency data exchange agreements, and establishing clear legal bases for integrated service delivery models.

Coordination and Collaboration Dimension addresses governance mechanisms ensuring sustained multi-stakeholder alignment:

1) Institutional Structures: Formal coordination bodies with genuine authority, adequate resources, and clear mandates. In Central Kalimantan, this requires strengthening the Provincial SPBE Coordination Team with executive backing, dedicated secretariat staff, enforcement authority, and budget control mechanisms enabling compliance incentivization
2) Vertical Coordination: Alignment mechanisms spanning national, provincial, and district government levels. Implementation necessitates establishing regular consultative forums, creating resource transfer mechanisms supporting district implementation of provincial standards, and developing joint planning processes ensuring local needs inform provincial system design.
3) Horizontal Coordination: Integration protocols across agencies at the same governmental level. This requires inter-agency working groups for cross-cutting issues (data standards, security protocols, user experience), shared service arrangements for common functions

(authentication, payment processing), and collaborative procurement, reducing redundant system development.

4) Multi-Stakeholder Collaboration: Engagement mechanisms incorporating private sector, civil society, academia, and citizens in digital governance design and implementation. Implementation involves creating public-private partnership frameworks for infrastructure investment, establishing citizen advisory panels for service design, and developing university collaborations for research and capacity building.

Implementation Pathway

The C7I Model's operationalization requires phased implementation, addressing contextual constraints while building toward comprehensive integration:

1) Phase 1: Foundation Strengthening (Years 1-2) prioritizes critical enablers: expanding connectivity to remaining blank spots through satellite and terrestrial solutions; increasing ICT budget allocations to a minimum of 3% of total expenditure; enacting comprehensive data protection and sharing regulations; and establishing a strengthened SPBE Coordination Team with executive authority and resources.

2) Phase 2: Capability Enhancement (Years 2-4) develops operational dimensions: implementing comprehensive civil servant digital competency development programs; conducting systematic application portfolio review, identifying critical systems for integration priority; establishing user experience standards and accessibility requirements; and deploying citizen engagement platforms enabling meaningful participation.

3) Phase 3: Integration Implementation (Years 3-5) operationalizes integrative mechanisms: developing and mandating a provincial interoperability framework, including technical standards, data definitions, and API requirements; establishing an enterprise service bus enabling system-to-system integration; implementing single sign-on authentication across government services; creating integrated service delivery models for priority citizen journeys; and formalizing inter-agency coordination protocols with performance accountability.

This phased approach recognizes resource constraints and capacity limitations while maintaining strategic coherence. Early phases create conditions enabling later integration efforts, while allowing quick wins demonstrating value and building momentum. Flexibility permits adaptation as implementation reveals unforeseen challenges or opportunities.

Model Validation and Applicability

The C7I Model's validity derives from multiple sources. Empirically, it directly addresses challenges documented through systematic data collection and analysis in Central Kalimantan, ensuring grounding in operational realities rather than abstract theorizing. Theoretically, it synthesizes established e-government frameworks with contemporary digital governance scholarship, particularly interoperability and coordination literature, achieving coherence with broader academic discourse (Meijer & Bekkers, 2015; Scholl & Klischewski, 2007). Practically, model components reflect achievable interventions within Indonesian governmental and regulatory contexts rather than requiring institutional transformations beyond realistic policy horizons.

The model's applicability extends beyond Central Kalimantan to regional governments confronting similar conditions: moderate digital maturity with uneven infrastructure, limited institutional capacity, fragmented system landscapes, and weak coordination mechanisms. Indonesian provinces sharing these characteristics much of Kalimantan, Sulawesi, Maluku, Nusa Tenggara, and Papua, represent immediate application contexts. More broadly, the model offers insights for regional governments in developing countries experiencing rapid digitalization without corresponding integration capacity, where application proliferation precedes interoperability planning and organizational silos persist despite technological possibilities for integration.

Model limitations merit acknowledgment. Its development from single-case analysis, while enabling contextual depth, limits generalizability claims pending validation in diverse settings. The model's comprehensiveness, while theoretically valuable, may overwhelm resource-constrained governments; simplified variants prioritizing critical dimensions may prove more implementable in severely constrained contexts. Finally, the model addresses technical and institutional dimensions more thoroughly than political economy factors—power dynamics, vested interests, and corruption—that fundamentally shape implementation possibilities in many contexts (Heeks, 2006).

Conclusion

This study examines digital governance transformation in the Central Kalimantan Provincial Government through a multidimensional analytical framework, yielding three principal contributions to e-government literature and regional policy practice in Indonesia.

First, empirical analysis reveals that despite substantial progress in digital technology adoption, with over 200 applications implemented and internet penetration reaching 79.5% digital governance implementation confronts systemic barriers that transcend mere technical or financial constraints. Assessment across Indrajit's (2002) six dimensions confirms multifaceted challenges: (1) content development shows application proliferation without integration, with 40% of systems experiencing significant downtime and inadequate interface design; (2) competency building is constrained by acute ICT professional scarcity (0.3% of total civil servants) and insufficient training programs; (3) connectivity still faces extreme geographical disparities with 186 villages remaining as "blank spots" without cellular coverage; (4) cyber laws demonstrate significant implementation gaps between comprehensive regulations and operational practice, with only 35% of systems implementing mandated encryption; (5) citizen interfaces experience fragmentation with unintegrated service channels and unequal digital participation between urban-rural populations; and (6) capital is limited by ICT budget allocation of only 1.2% of total provincial budget, far below the 3-5% national standard.

Second, cross-dimensional analysis identifies three fundamental structural deficits underlying implementation challenges: system fragmentation and absence of interoperability, where applications operate as isolated data silos without technical, semantic, or organizational integration standards; inadequate coordination mechanisms, with formal coordination bodies lacking enforcement authority, resources, or accountability to ensure cross-agency compliance; and sustainability vulnerabilities, reflecting inadequate lifecycle planning, vendor dependency, and uninstitutionalized governance practices. These findings demonstrate that digital governance progress requires more than strengthening individual dimensions; systemic integration and multi-stakeholder coordination are equally essential prerequisites, inadequately conceptualized in traditional e-government frameworks. Third, this study develops the C7I Model (Content, Competency, Connectivity, Cyber Laws, Citizen Interfaces, Capital, Interoperability, and Coordination-Collaboration), a recontextualized framework extending Indrajit's model by explicitly integrating interoperability and coordination-collaboration as distinct analytical and operational dimensions. The model is structured in three interconnected layers: *foundational enablers* (connectivity, capital, cyber laws), *operational capabilities* (content, competency, citizen interfaces), and *integrative mechanisms* (interoperability, coordination-collaboration). The interoperability dimension encompasses four levels: technical, semantic, organizational, and legal—each requiring specific interventions from API standardization to regulatory framework harmonization. The coordination-collaboration dimension encompasses institutional structures, vertical and horizontal coordination, and multi-stakeholder collaboration, ensuring sustained strategic alignment.

The C7I Model represents a theoretical contribution responding directly to contemporary realities of fragmented digital ecosystems in Indonesian regional government and similar developing country contexts. By elevating interoperability and coordination to equal status with Indrajit's original dimensions, the model bridges the gap between classic e-government frameworks developed in early technological contexts and the system integration and networked governance imperatives dominating contemporary digital governance discourse. The model's empirical validation through systematic data from Central Kalimantan ensures conceptual extensions remain connected to actual implementation challenges rather than theoretical abstractions.

C7I Model implementation requires a phased approach, recognizing capacity constraints while maintaining strategic coherence: Phase 1 (Years 1-2) prioritizes foundation strengthening through connectivity expansion, increased ICT budget allocation, comprehensive data protection and sharing regulation enactment, and SPBE Coordination Team strengthening. Phase 2 (Years 2-4) develops operational capabilities through civil servant digital competency programs, systematic application portfolio review, user experience standards establishment, and citizen engagement platform deployment. Phase 3 (Years 3-5) operationalizes integrative mechanisms through provincial interoperability framework development and mandate, enterprise service bus implementation, cross-government single sign-on systems, integrated service delivery models, and formalized inter-agency coordination protocols with performance accountability.

This research demonstrates that digital governance transformation in Indonesian regional contexts requires fundamental reconceptualizations transcending technocratic modernization paradigms.

Effective digitalization is not merely system implementation or process automation, but institutional relationship reconfiguration, cross-organizational boundary process reengineering, and collaborative governance capacity development. The fragmentation documented in Central Kalimantan, where application proliferation occurs without integration, infrastructure develops without equalization, and regulations are established without enforcement, reflects broader patterns in Indonesian regional government where technology adoption precedes institutional capacity building to manage complex digital ecosystems.

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