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From SPBE to Digital Government: Longitudinal Trajectory, Readiness Diagnostics, and Intervention Typology of Districts in Lampung Province

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Abstract

Indonesia is transitioning from Electronic-Based Government Systems (SPBE) to Digital Government (PemDi) under Presidential Regulation No. 82 of 2023. Lampung Province exhibits an empirical paradox: while the mean SPBE score across 15 districts increased by 24.8% between 2023 and 2025, inter-district inequality also widened. This study adopts a diagnostic multi-year comparative design with three analytical streams: (1) longitudinal SPBE trajectory analysis (growth rates, transition matrices, clustering, and sigma-convergence); (2) a PemDi readiness assessment based on four clusters and 19 sub-categories (0–120 scale); and (3) integration through a 2×2 joint display. The findings indicate sigma-divergence rather than convergence over 2023–2025, with the standard deviation of SPBE scores increasing from 0.36 to 0.39. A path-dependent pattern is also evident: of the 13 districts classified in Tier 4 in 2023, only two advanced by more than one tier. PemDi readiness varies substantially across districts (66–118 out of 120), with the main provincial bottlenecks concentrated in Data Security (8 of 15 districts scored 0) and IT Operations/Helpdesk (7 of 15 districts scored 0). The joint display further reveals False Readiness and Execution Gap paradoxes that remain less visible under conventional evaluations. Although preliminary and limited to one province, the study extends the boundary conditions of Rogers' diffusion of innovations theory by showing that mandatory adoption does not necessarily produce convergence. Based on these results, it proposes a Three-Layer Digital Convergence Framework (Governance, Resources, Technical) with a differentiated roadmap for district typologies during 2026–2028.

1. Introduction

Indonesia is undergoing a fundamental transition in digital government administration.Presidential Regulation No. 95/2018 on Sistem Pemerintahan Berbasis Elektronik (SPBE, Electronic-Based Government Systems) has served as the national framework for nearly a decade and has now been extended by Presidential Regulation No. 82/2023, which mandates a transformation to Digital Government (Pemerintahan Digital/PemDi), a more holistic paradigm encompassing governance, cybersecurity, government services, and infrastructure [1]. This transition aligns with the global evolution from digitization to contextualization identified by Janowski [2] and is reinforced by the OECD [3], which argues that digital government is not simply a more advanced form of e-government but a distinct paradigm that positions data, service design, and the digital ecosystem as its foundation. Lampung Province, comprising 15 districts and municipalities that have all been evaluated under SPBE since 2023, exhibits an empirical paradox that is both academically compelling and policy-urgent.

SPBE evaluation data from the Ministry of Administrative and Bureaucratic Reform (Kementerian PANRB) [4], [5], [6] indicate that the provincial mean SPBE score across 15 districts rose by 24.8%, from 2.54 in 2023 to 3.17 in 2025. However, the standard deviation increased from 0.36 to 0.39 (+ 8.3%), and the coefficient of variation (CV) remained persistently above 12% over the three-year period. Taken together, these indicators point to sigma-divergence, a pattern in which inter-district digital inequality widens rather than narrows despite aggregate improvement.

This pattern of “rising mean coupled with widening disparity” is consistent with the cumulative advantage mechanism described by Van Dijk [7] and the Matthew Effect articulated by Merton [8], whereby mandatory policies may inadvertently amplify inequality because better-resourced entities possess greater capacity to respond. Empirically, of the 13 districts classified in Tier 4 (the lowest tier) in 2023, only two advanced by more than one tier by 2025, while two districts remained stagnant and none reached Tier 1.

This study addresses three gaps in the existing literature. First, prior SPBE studies in Indonesia are predominantly cross-sectional or nationally aggregated evaluations [9], [10]; to date, no study has analyzed multi-year longitudinal trajectories at the district level. Second, no study has integrated SPBE trajectory analysis (a historical perspective) with Digital Government readiness assessment (a prospective perspective) within a unified diagnostic framework. Third, the sigma-convergence approach applied by Aumeboonsuke at the inter-country ASEAN level and by Yulianto and Khairunnisa at the inter-provincial level in Indonesia has not, to the best of the authors’ knowledge, been applied to SPBE data at the district level [11], [12].

To address these gaps, this study poses three hierarchically structured research questions:

RQ1. What are the trajectory patterns of SPBE readiness across 15 districts in Lampung Province from 2023 to 2025, and does sigma-convergence or sigma-divergence occur?

RQ2. What is the structural readiness profile of Digital Government (PemDi) across these districts, and what are the most critical provincial bottlenecks?

RQ3. How does the integration of SPBE trajectory and PemDi readiness classify district typologies and reveal paradoxes that are not detected by conventional evaluations?

This study offers three contributions. Methodologically, it is the first to apply sigma-convergence analysis and a dual-lens joint display to SPBE data at the district level in Indonesia, extending an approach commonly used at the international level to a more granular unit of analysis [13]. Theoretically, it extends the boundary conditions of Rogers’ diffusion of innovations theory by demonstrating that, in a mandatory adoption context, the convergence assumption does not necessarily hold [14]. Practically, it proposes a Three-Layer Digital Convergence Framework (Governance, Resources, Technical) differentiated by district typology, accompanied by an implementation roadmap for 2026–2028.

2. Related works

This section reviews three streams of literature that frame the present study: (a) e-government maturity and SPBE evaluation research in Indonesia, (b) the sigma-convergence approach to digital inequality, and (c) digital government readiness assessment frameworks.

2.1. E-Government maturity and SPBE studies in Indonesia

Research on SPBE in Indonesia has predominantly adopted cross-sectional designs that evaluate maturity at a single point in time. Yunita and Aprianto [9] assessed SPBE implementation nationally but did not track changes across years. Harijadi and Saputro [10] analyzed SPBE maturity at the local government level, yet their analysis remained limited to one evaluation period.

More recent studies have expanded the scope of SPBE research but remain constrained by similar methodological limitations. Nugraha et al. [32] conducted a systematic literature review of SPBE maturity across Indonesian local governments using evaluation reports from 2018 to 2024, confirming that while the national SPBE score improved from 2.34 (2022) to 2.79 (2023) and the EGDI ranking rose from 107th to 64th, significant regional disparities persist. Their study identified regulatory clarity, local leadership, and capacity-building as key enablers, but did not employ longitudinal trajectory analysis to examine how individual districts evolve over time. D. Cahyadi and Y. T. Keban [33] applied PLS-SEM to 383 district governments using the TOE framework (Technology-Organization-Environment), demonstrating that technology infrastructure, organizational capacity (finance and HR), and environmental factors (human development) significantly predict SPBE maturity. This finding provides a determinant-based complement to the maturity-level diagnosis undertaken in the present study. D. Gartika and A. Widiyanto [34] examined e-government implementation in Bali Province, offering a provincial-level case study, yet their analysis also remained cross-sectional without convergence testing. These studies provide valuable snapshots but cannot capture trajectory dynamics, such as whether districts converge, diverge, or follow distinct developmental paths over time. Internationally, Janowski [2] proposed a four-stage digital government evolution model (digitization → transformation → engagement → contextualization), arguing that progression is neither linear nor guaranteed.

Fountain [22] further theorized that public-sector technology is enacted through existing institutional structures, implying that organizational capacity, not the technology mandate itself, determines actual adoption outcomes. These theoretical insights suggest that longitudinal trajectory analysis, rather than cross-sectional evaluation, is needed to understand how districts evolve under a mandatory framework.

The importance of longitudinal and interoperability-ready data governance is further underscored by the Satu Data Indonesia policy [31], which mandates that all government data adhere to standardized definitions, formats, and interoperability protocols by 2027. This policy creates an additional convergence pressure — districts that fail to standardize risk exclusion from the national data ecosystem, amplifying the Matthew Effect identified in Section 1.

2.2. Sigma-convergence and the digital divide

The sigma-convergence method, originating from economic growth theory, has been widely used to assess whether digital inequality narrows or widens over time. At the international level, Aumeboonsuke [11] compares the EU and ASEAN during 2010–2024 and shows that while the EU demonstrates more consistent convergence across digital indices, ASEAN exhibits mixed patterns of convergence and divergence, especially in the post-pandemic period. Complementing this regional comparison, Abd Rashid et al. [35] examine five lower-HDI ASEAN countries (Indonesia, the Philippines, Vietnam,

Cambodia, and Laos) and find persistent disparities in digital infrastructure and adoption. Their results indicate that aggregate digital progress does not automatically produce equitable convergence. At the Indonesian level, Yulianto and Khairunnisa [12] identify persistent ICT heterogeneity across provinces, confirming that national progress may coexist with substantial inter-regional inequality.

These findings are theoretically consistent with Van Dijk's cumulative advantage framework [7] and Merton's Matthew Effect [8], both of which suggest that entities with stronger initial capacities are more likely to accumulate further benefits from digital investment, whereas weaker entities risk falling further behind. The implication is that mandatory digital reform does not necessarily generate convergence unless underlying institutional and resource asymmetries are addressed. However, no study has applied sigma-convergence analysis to district-level SPBE evaluation data within a single province, leaving an important gap in understanding whether divergence patterns observed at the international and inter-provincial levels also operate at the intra-provincial level.

2.3. Digital government readiness frameworks

Digital readiness assessment spans multiple frameworks across the international literature. The OECD Digital Government Index [3] evaluates readiness across six dimensions with emphasis on data-driven governance. The United Nations E-Government Survey [28] provides a composite index at the national level, while the World Bank GovTech Maturity Index [29] focuses on core government systems, service delivery, citizen engagement, and institutional enablers. At the sub-national level, readiness assessment instruments are less standardized. Heeks [24] identified the design-reality gap as a persistent challenge: readiness scores based on policy and infrastructure inputs often overstate actual operational capability. COBIT 2019 [20] addresses this through governance and management objectives that distinguish between policy-level compliance and operational capability, a distinction that is central to the present study's diagnostic approach.

Complementing the governance-management distinction, Pardo and Burke [30] argue that governance capability functions as a prerequisite, not merely a complement, to technical capability in government interoperability contexts. Their framework posits that without governance foundations (shared definitions, institutional coordination, accountability structures), technical investments are unlikely to yield sustainable integration outcomes. This sequencing logic informs the layered architecture of the intervention framework developed in Section 4.5.

Pick and Sarkar [23] argue that effective digital inclusion strategies require differentiated interventions based on the specific readiness profile of each entity, rather than uniform policies. This principle informs the intervention typology developed in this study.

2.4. Research positioning

Prior studies on SPBE and local e-government in Indonesia have generated important insights, yet they remain dominated by cross-sectional evaluation, determinant analysis, and literature synthesis rather than longitudinal diagnosis of district trajectories. Studies such as Yunita and Aprianto [9], Harijadi and

Saputro [10], Nugraha et al. [32], D. Cahyadi and Y. T. Keban [33], and D. Gartika and A. Widiyanto [34] consistently show that SPBE performance is shaped by regulation, organizational capacity, leadership, and regional inequality. However, these studies do not explain how districts move over time, whether they converge or diverge, or how recent SPBE improvement relates to broader Digital Government readiness.

At the international level, adjacent but still separate lines of inquiry can also be identified. On the one hand, convergence-oriented studies such as Aumeboonsuke [11] and Abd Rashid et al [35]. examine digital inequality across countries and show that aggregate digital progress does not necessarily imply convergence. On the other hand, readiness-oriented frameworks such as the OECD Digital Government Index [3], the United Nations E-Government Survey [28], and the World Bank GovTech Maturity Index [29] emphasize governance capacity, service capability, and institutional enablers, but generally do not connect these readiness conditions to observed multi-year performance trajectories at the sub-national level.

Table 1 summarizes how the present study is positioned relative to prior Indonesian and international research on digital convergence, SPBE maturity, and sub-national digital government assessment.

Table 1
Research positioning relative to prior studies

Study	Scope	Analytical Lens	Positioning Gap
V. Aumeboonsuke [11]	EU and ASEAN countries; 2010–2024	Regional digital convergence/divergence; sigma/beta analysis; readiness not assessed	Inter-country level; no sub-national government readiness diagnosis + 1
Abd Rashid et al. [35]	Five lower-HDI ASEAN countries; multi-year	Digital divide and sigma/beta-convergence; readiness not assessed	Country-level digital access/adoption, not government performance trajectories
E. Yulianto and H. Khairunnisa [12]	Indonesian provinces; cross-sectional	ICT heterogeneity; partial convergence perspective; no readiness	Does not trace district movement over time or integrate readiness
A. Yunita and R. D. Aprianto [9]	Indonesia national; cross-sectional	SPBE implementation evaluation only	National snapshot; no trajectory or convergence analysis
B. Harijadi and D. Saputro [10]	Local governments; cross-sectional	SPBE maturity assessment only	One-period maturity view; no longitudinal or integrated diagnosis
B. Nugraha et al. [32]	Indonesia national SLR; 2018–2024	Literature synthesis on SPBE maturity and disparities	Synthesizes determinants but does not test trajectories empirically
D. Cahyadi and Y. T. Keban [33]	383 districts; cross-sectional 2021	Determinants of SPBE maturity using TOE	Explains drivers, but not convergence/divergence over time
D. Gartika and A. Widiyanto [34]	Bali Province; cross-sectional	Provincial e-government implementation	No longitudinal testing and no readiness integration
This study	**15 districts in Lampung; from 2023 to 2025 trajectory + 2026 readiness**	**Trajectory diagnosis, sigma-convergence, and joint-display readiness integration**	**Combines district-level longitudinal analysis and readiness typology in one sub-national design**

As shown in Table 1, prior studies tend to examine either convergence patterns without government-readiness diagnosis, or SPBE and digital government conditions without longitudinal convergence testing. The present study addresses this gap by combining both lenses in a single sub-national diagnostic design. Methodologically, it extends sigma-convergence analysis from the inter-country and inter-provincial level to the intra-provincial district level and integrates that lens with a joint display to generate typologies that would not be visible through a single-lens evaluation. Empirically, Lampung Province provides a strategically relevant bounded case because it offers complete multi-year SPBE data, substantial inter-district heterogeneity, and immediate policy relevance during the transition from SPBE to Digital Government. In this sense, the study contributes not only to Indonesian SPBE scholarship

but also to the broader debate on how mandatory digital adoption unfolds under conditions of uneven institutional capacity.

3. Research method

3.1. Research design

This study adopts a diagnostic multi-year comparative case study design that combines multiple quantitative data sources and analytical streams within a single integrated framework. This approach is consistent with mixed methods principles that emphasize the planned integration of complementary datasets to generate meta-inferences beyond what single-strand designs can provide [21]. Rather than evaluating local governments against an abstract ideal benchmark, the study is designed to diagnose actual trajectory patterns, readiness gaps, and intervention priorities within a bounded provincial setting. This orientation follows Yin, who distinguishes diagnostic case studies from normative evaluations, and aligns with the OECD's emphasis on evidence-based digital government policy grounded in contextual diagnosis [3], [18].

The design operationalizes three sequential and complementary analytical streams. Stream A, Longitudinal Trajectory Analysis, examines the movement patterns of SPBE scores across 15 districts and municipalities in Lampung Province from 2023 to 2025 using official evaluation data from the Ministry of PANRB [3], [4], [5]. Its outputs include growth rates, a transition matrix, K-Means clustering, and sigma-convergence testing. Stream B, Structural Readiness Analysis, maps the Digital Government (PemDi) readiness profile based on the 2026 provincial assessment, covering four clusters and 19 sub-categories on a 0–120 scale. Its outputs include readiness profiling, a gap heatmap, and a Provincial Priority Index for bottleneck identification. Stream C, Integration and Synthesis, merges the outputs of Streams A and B through a 2×2 joint display to derive district typologies and provide the empirical basis for the Three-Layer Digital Convergence Framework.

Integration follows the merging logic recommended by Fetters, Curry, and Creswell, whereby two sets of quantitative findings are combined in a single visual representation to generate meta-inferences that exceed the capacity of separate analyses [15]. In this study, the purpose of integration is not merely to compare two score systems but to identify mismatches between historical execution and forward-looking readiness that may remain hidden under conventional single-lens evaluations. This logic directly supports the study's third research question and provides the bridge from descriptive diagnosis to differentiated intervention design.

Figure 1 depicts the overall research design and analytical integration flow of this study. The figure clarifies how the study moves from two primary quantitative inputs toward an integrated diagnostic output, rather than treating trajectory analysis and readiness assessment as separate descriptive exercises.

Stream A uses longitudinal SPBE evaluation data from 2023 to 2025 to generate retrospective trajectory outputs, including growth rates, a transition matrix, K-Means clustering, and sigma-convergence testing.

Stream B uses the 2026 PemDi readiness assessment to generate structural readiness outputs, including readiness profiling, a gap heatmap, and the Provincial Priority Index for bottleneck identification.

Stream C then merges the outputs of Streams A and B through a 2×2 joint display to classify district typologies and provide the empirical basis for the Three-Layer Digital Convergence Framework and the 2026–2028 implementation roadmap.

This visual representation reinforces the diagnostic orientation of the study, namely that the objective is to identify differentiated intervention needs within a bounded context rather than to conduct a purely normative evaluation against an abstract ideal benchmark.

3.2. Case context: Lampung province

The unit of analysis comprises 15 districts and municipalities in Lampung Province, all of which have been evaluated under SPBE by the Ministry of PANRB since 2023. The province was selected purposively based on three criteria. First, data completeness: all 15 districts possess three consecutive years of SPBE data, from 2023 to 2025, without missing values, producing a complete enumeration of 45 district-year observations and 180 dimension-level observations. This complete coverage eliminates selection bias and non-response bias within the province. Second, heterogeneity: in 2023, 14 of the 15 districts were classified in lower SPBE tiers, with only Mesuji in Tier 2 and none in Tier 1, while the coefficient of variation remained persistently above 12 percent across the study period. This condition makes Lampung a relevant case for investigating divergence patterns and uneven institutional adaptation. Third, policy relevance: Lampung is in the process of preparing a province-wide transition from SPBE toward Digital Government, which gives the findings immediate practical utility.

The scope of this study is strictly within-province. Accordingly, all findings are interpreted as specific to the Lampung context and are not generalized to other provinces without replication. This bounded scope follows the principle of contextual generalization in case-based research and is consistent with the diagnostic rather than inferential orientation of the study.

3.3. Data sources

This study uses official secondary data from two primary sources, supplemented by supporting data for triangulation. The first primary source is SPBE evaluation scores from the Ministry of PANRB from 2023 to 2025, consisting of the overall index and four dimensions across 15 districts. These data serve Stream A for trajectory analysis, clustering, transition mapping, and sigma-convergence testing. The second primary source is the 2026 PemDi readiness assessment from the Provincial Diskominfo, structured into four clusters and 19 sub-categories with a total score range of 0 to 120. These data serve Stream B for readiness profiling, heatmap construction, and Provincial Priority Index analysis.

Supporting data include APBD and IT budget figures from BPKAD/DJPK from 2023 to 2025, IT human resource counts from district-level Diskominfo offices for 2025, and confirmatory interviews with selected Diskominfo officials for contextual validation of the quantitative findings. These supporting materials are used to strengthen interpretation and triangulation rather than to function as independent primary evidence. Interviews are therefore cited anonymously as Informant 1, Informant 2, and so forth.

Unlike many e-government studies that rely primarily on self-report survey data, the present study is grounded in formal assessment results conducted by official PANRB assessors using a standardized and mandatory instrument. For this reason, the SPBE evidence used here approaches audit-grade measurement more closely than perception-based indicators. Even so, the readiness integration and typological interpretation remain descriptive-comparative rather than causal in nature.

Data integrity was maintained through three protocols. First, a completeness check confirmed 0 percent missing data across all SPBE and readiness data points included in the study. Second, a temporal consistency check yielded inter-year SPBE correlations of approximately 0.98 for 2023 to 2024 and 0.99 for 2024 to 2025, indicating instrument stability and suggesting that heterogeneity patterns are structural rather than random. Third, a reconciliation and sensitivity analysis were conducted for three districts with duplicate PemDi records: Way Kanan, Bandar Lampung, and Lampung Selatan and no quadrant membership changed under alternative scoring. This result indicates that the integrated classification remains robust under minor data reconciliation adjustments.

3.4. Analytical techniques

The analytical strategy is divided into three streams that correspond directly to the three research questions. This structure ensures coherence between the research design, the evidence base, and the logic of interpretation presented in section 4.

3.4.1. Stream A: SPBE trajectory analysis

Trajectory analysis proceeds through five stages. First, multi-year descriptive statistics are computed for each year, including mean, standard deviation, coefficient of variation, and maximum-minimum gap. In this study, the coefficient of variation is used as a scale-free indicator of heterogeneity across districts. Second, the growth rate for each district is calculated as the percentage change in SPBE score between 2023 and 2025 relative to the 2023 baseline, as shown in Eq. (1).

$$GrowthRate = ((\,Score_\{2025\} - Score_\{2023\})/Score_\{2023\,\}) \times 100\% \,(1)$$

Third, a 4×4 transition matrix is constructed to track district movement across SPBE tiers from 2023 to 2025. This step follows Quah, who argues that aggregate statistics may conceal important intra-distribution dynamics. Fourth, sigma-convergence testing is performed by comparing the standard deviation of district scores across years. A decreasing standard deviation indicates convergence, whereas an increasing standard deviation indicates divergence. Fifth, K-Means trajectory clustering with k = 4 is applied using three variables: mean SPBE score across three years, growth rate, and individual

volatility measured by standard deviation. The purpose of this clustering is not predictive modeling, but empirical grouping to support pattern diagnosis and later integration with readiness findings.

3.4.2. Stream B: PemDi readiness analysis

The PemDi readiness assessment is structured into four clusters: Governance with a maximum score of 42, Cybersecurity with 18, Government Services with 36, and Infrastructure with 24. Across these clusters, 19 sub-categories are scored on a 0–2 scale, yielding a total maximum of 120. Three analytical techniques are applied in this stream.

First, gap analysis is conducted based on minimum scores rather than mean scores. This choice is justified by the weakest-link logic, in which system vulnerability is shaped by the least developed critical component rather than by average capability. Second, a readiness heatmap is constructed across 15 districts and 19 sub-categories in order to distinguish systemic weaknesses from isolated weaknesses. Systemic weaknesses are those that recur across many districts, while isolated weaknesses are district-specific and therefore less suitable for province-wide intervention prioritization. Third, a Provincial Priority Index is calculated by counting the number of districts scoring 0 and 0–1 in each sub-category. This index is used to identify the Top-5 bottlenecks and to classify them into priority bands such as High and Medium rather than imposing a rigid ordinal ranking. This priority-band approach is retained because it is more defensible for diagnostic interpretation in a small-N provincial dataset.

3.4.3. Stream C: Integration through joint display

Integration is conducted through a 2×2 joint display [16]. The X-axis represents SPBE growth rate from 2023 to 2025, while the Y-axis represents total PemDi readiness score in 2026. Cut-offs are set at the medians of both variables, namely 25.8 percent for growth rate and 83 out of 120 for readiness. These cut-offs divide the districts into four quadrants. Quadrant A, Champion, represents high trajectory combined with high readiness and implies a maintain-and-mentor strategy. Quadrant B, False Readiness, represents high trajectory combined with low readiness and implies a freeze-and-fix strategy. Quadrant C, Execution Gap, represents low trajectory combined with high readiness and implies an accelerate-delivery strategy. Quadrant D, Critical State, represents low trajectory combined with low readiness and implies an emergency intervention strategy.

This integration follows the joint display approach suggested by Fetters, Curry, and Creswell [15], but it is adapted here for the integration of two quantitative streams rather than for mixed quantitative-qualitative convergence alone. The analytical purpose is to generate district typologies and paradox diagnosis, especially conditions in which recent SPBE progress and underlying Digital Government readiness do not move in the same direction. In this sense, the joint display functions as the central diagnostic bridge between measurement and intervention design.

3.5. Validity, reliability, and boundaries

Internal validity is maintained through multi-source triangulation across four independent sources: SPBE data from PANRB, PemDi readiness data from Provincial Diskominfo, fiscal data from BPKD/DJPK, and

HR data from district Diskominfo offices. Reliability is supported through operational transparency, since all cut-offs, weightings, categorization rules, and reconciliation procedures are documented explicitly in the research design. Construct validity is strengthened by the use of official standardized instruments rather than self-report perception measures. External validity remains bounded to the Lampung context, and transferability to other provinces requires replication under comparable institutional conditions.

In addition, the reliance on archival assessment data from multiple institutional sources, rather than single-source self-report survey data, is consistent with recommendations for minimizing common method bias in social science research [17]. All findings in this study are interpreted using an epistemic claim hierarchy. Descriptive claims are treated as the strongest because they report observed values directly from official assessment data. Comparative claims are treated as moderate because they contrast districts within the bounded Lampung dataset. Interpretive claims are treated as the weakest and are therefore presented with explicit qualifiers, given the short observation window, the single-province scope, and the descriptive-comparative design of the study. This positioning is consistent with the diagnostic purpose of the research, which is to inform differentiated intervention priorities rather than to claim causal inference or universal generalization.

In line with this principle, the study does not claim that any single factor deterministically causes district performance differences. Instead, the analyses identify patterns, bottlenecks, and typological contrasts that are consistent with the broader literature on cumulative advantage, institutional path dependency, and design-reality gaps in digital government implementation. These validity and reliability considerations provide the methodological basis for the trajectory findings in Section 4.2, the readiness diagnosis in Section 4.3, the integrated typology in Section 4.4, and the framework development in Section 4.5.

4. Results and discussion

4.1. Data integrity and analytic robustness

Before presenting the substantive findings, this study first reports the integrity of the dataset and the robustness of the analytical preparation. This step is important because the empirical objective is diagnostic interpretation rather than causal estimation, and the credibility of such interpretation depends on the transparency and internal consistency of the measurement evidence. In line with the methodological position established in Section 3, the purpose of this section is not to claim statistical generalizability but to demonstrate that the observed provincial patterns are grounded in complete, stable, and cross-validated evidence rather than in fragmented or noisy data.

4.1.1. Data completeness check

The dataset used in this study is complete within the bounded provincial case. For the SPBE trajectory component, all 15 districts and municipalities in Lampung Province possess official SPBE scores for

three consecutive years 2023, 2024, and 2025—resulting in 45 district-year observations for the overall index. In addition, dimensional SPBE data are available for all districts across all three years, yielding full coverage for the four dimensions without missing observations.

For the PemDi readiness component, the provincial assessment dataset covers all 15 districts using the same 2026 instrument, structured into four clusters and 19 sub-categories with a maximum score of 120. No district is excluded from the readiness profiling stage, which ensures full comparability between the trajectory and readiness streams during joint display integration. This completeness is methodologically important because the study relies on complete enumeration rather than sampling, thereby minimizing the risk of selection bias or non-response distortion within the Lampung case boundary.

4.1.2. Consistency check across years

Beyond completeness, the SPBE dataset also exhibits strong temporal consistency across the three-year observation window. As noted in the method section, inter-year correlations are very high, with approximately $r_{2023–2024}$=0.98 and $r_{2024–2025}$=0.99.

These coefficients indicate that relative district positions remain highly stable over time, suggesting that the observed heterogeneity is unlikely to be explained by random year-to-year fluctuation alone. This pattern is substantively relevant for the present study: if district rankings had shifted erratically across years, the widening disparity observed in later analyses could have been interpreted as a measurement artifact or a transient anomaly. Instead, the high year-to-year consistency supports the interpretation that the provincial pattern reflects a structural characteristic of uneven digital capacity, which is precisely the type of condition that diagnostic trajectory analysis is intended to capture.

4.1.3. Reconciliation and sensitivity check

A further robustness check was conducted for the 2026 PemDi readiness dataset because duplicate records were identified for three districts: Way Kanan, Bandar Lampung, and Lampung Selatan. Rather than discarding these records without review, the data were reconciled through comparison across entries and sensitivity testing under alternative scoring choices. The purpose of this procedure was to assess whether minor record-level discrepancies would materially alter the typology generated in the integration stage.

The sensitivity analysis shows that no district changed quadrant membership under alternative reconciliation choices. This result is important because the joint display is used to derive intervention typologies such as Champion, False Readiness, Execution Gap, and Critical State. The robustness of quadrant membership indicates that the integrated classification is not dependent on a single fragile scoring decision but remains substantively stable under reasonable alternative treatments of the duplicate records.

4.1.4. Triangulation with supporting evidence

The quantitative dataset is further supported by triangulation with secondary contextual evidence, including APBD and IT budget data, district-level IT human resource information, and confirmatory interviews with selected officials. In this study, triangulation does not serve as an independent causal test; rather, it is used to validate whether the quantitative patterns are operationally plausible and to reduce the risk of over-interpreting formal scores in isolation. This is consistent with the diagnostic orientation adopted throughout the paper, whereby interpretation is strengthened by convergence across multiple evidence sources rather than by inferential statistics alone.

The triangulation strategy is particularly important because the study combines two different but complementary lenses: historical SPBE performance and forward-looking PemDi readiness. Supporting evidence on fiscal capacity, human resources, and administrative processes helps explain why some districts improve rapidly from a low base, why others plateau despite high scores, and why formal readiness may diverge from operational execution. Accordingly, the supporting data function as interpretive anchors that enhance analytic credibility while remaining secondary to the official assessment datasets.

4.1.5. Interpretive boundary of robustness

The evidence presented in this section increases confidence that the patterns reported in the subsequent analysis are not artifacts of missing data, unstable measurement, or isolated reconciliation choices. However, robustness in this study should be interpreted in a bounded sense. It indicates that the observed patterns are internally coherent and analytically defensible within the Lampung dataset, not that they establish causal relationships or guarantee external generalizability beyond the case.

For that reason, the findings in the next sections are interpreted through an epistemic hierarchy consistent with Section 3: descriptive claims are treated as strongest, comparative claims as moderate, and interpretive claims as conditional. This framing allows the study to present strong measurement evidence and meaningful diagnostic insight while maintaining methodological humility about what a small-N, single-province, descriptive-comparative design can legitimately support. In addition, the use of district-level aggregates implies that the findings speak to ecological patterns rather than individual behaviors, consistent with Robinson's caution regarding ecological correlations [27].

4.2. SPBE trajectory analysis (RQ1)

This section addresses Research Question 1: What are the trajectory patterns of SPBE readiness across 15 districts in Lampung Province from 2023 to 2025, and does sigma-convergence or sigma-divergence occur? The analysis is organized into five components: multi-year descriptive statistics, growth rate categorization, transition matrix analysis, sigma-convergence testing, and trajectory clustering. Each component serves a distinct diagnostic purpose within the overall trajectory analysis.

4.2.1. Multi-year descriptive statistics

Table 2 presents descriptive statistics for SPBE scores across 15 districts in Lampung Province from 2023 to 2025, based on data provided by the Ministry of PANRB.

Table 2
Descriptive statistics of SPBE scores in Lampung Province, from 2023 to 2025

Indicator	2023	2024	2025	Δ Trend	Interpretation
Mean	2.54	2.93	3.17	↑ 24.8%	Positive aggregate progress
SD	0.36	0.42	0.39	↑ 8.3%	Divergence confirmed
Max	3.61 (Mesuji)	3.83 (Mesuji)	3.92 (Mesuji)	↑	Top performers accelerating
Min	2.06 (Pesisir Barat)	2.30 (TBB)	2.41 (Lamteng)	↑ slow	Laggards struggling
Gap Max-Min	1.55	1.53	1.51	≈ stable	Absolute gap persistent
CV (%)	14.2	14.3	12.3	High	Persistent heterogeneity

The data point to the central paradox of this study. While the provincial mean SPBE score increased by 24.8%, from 2.54 in 2023 to 3.17 in 2025, indicating positive aggregate progress, the standard deviation also rose by 8.3%, from 0.36 to 0.39.

At the same time, the coefficient of variation remained persistently above 12% throughout the three-year period, confirming that inter-district heterogeneity did not diminish. The absolute gap between the highest and lowest scoring districts remained approximately stable at around 1.5 points, indicating that improvement among lagging districts has not kept pace with advancement among top performers.

This pattern is consistent with the sigma-divergence hypothesis [13] introduced in Section 1 and is empirically aligned with the cumulative advantage mechanism described by Van Dijk [7] and the Matthew Effect articulated by Merton [8]. The pattern suggests that mandatory policy adoption does not automatically translate into convergence if underlying capacity differences remain unaddressed.

4.2.2. Growth rate and trajectory categorization

Table 3 presents the SPBE growth rate per district between 2023 and 2025, categorized into four trajectory groups: Fast Mover (> 30%), Gradual Improver (15–30%), Steady Performer (10–15%), and Stagnant (< 10%).

Table 3
District SPBE growth rates and trajectory categories, from 2023 to 2025

District	2023	2025	Growth (%)	Tier 2025	Category
Pesisir Barat	2.06	3.42	66.0	Tier 3	Fast Mover (low base)
Tanggamus	2.38	3.46	45.4	Tier 3	Fast Mover
Tulang Bawang	2.22	3.22	45.0	Tier 3	Fast Mover
Kota Metro	2.72	3.65	34.2	Tier 2	Fast Mover
Pesawaran	2.73	3.55	30.0	Tier 2	Fast Mover
Lampung Timur	2.28	2.95	29.4	Tier 3	Gradual Improver
Bandar Lampung	2.35	3.02	28.5	Tier 3	Gradual Improver
Lampung Selatan	2.48	3.16	27.4	Tier 3	Gradual Improver
Lampung Barat	2.52	3.17	25.8	Tier 3	Gradual Improver
Lampung Utara	2.45	3.06	24.9	Tier 3	Gradual Improver
Way Kanan	2.91	3.31	13.7	Tier 3	Steady Performer
Mesuji	3.61	3.92	8.6	Tier 2	Stagnant (plateau)
TBB	2.32	2.51	8.2	Tier 4	Stagnant
Lampung Tengah	2.31	2.41	4.3	Tier 4	Stagnant
Pringsewu	2.74	2.81	2.6	Tier 3	Stagnant

Five districts are categorized as Fast Movers (growth > 30%), led by Pesisir Barat (66.0%, attributable to a low-base effect) and Tanggamus (45.4%). Conversely, four districts are classified as Stagnant (< 10%): Mesuji (8.6%, a plateau effect at Tier 2), TBB (8.2%), Lampung Tengah (4.3%), and Pringsewu (2.6%). The growth rate range of 2.6% to 66.0% is consistent with substantial intra-provincial heterogeneity [7], [23].

It is important to note that high growth rates do not always indicate high absolute maturity. Pesisir Barat, for instance, grew 66.0% but remained in Tier 3 by 2025, whereas Mesuji grew only 8.6% but maintained Tier 2 status. This distinction between growth rate and maturity level becomes critical in the integration stage, where trajectory is combined with readiness to generate intervention typologies.

4.2.3. Transition matrix: Inter-tier mobility

Table 4 presents the transition matrix tracking tier movement from 2023 to 2025.

Table 4
Transition matrix of SPBE tiers, from 2023 to 2025

Tier (2023) ↓	→ Tier 1	→ Tier 2	→ Tier 3	→ Tier 4	Total
Tier 2	0	1 (Mesuji)	0	0	**1**
Tier 3	0	0	1 (Way Kanan)	0	**1**
Tier 4	0	2 (Metro, Pesawaran)	9	2 (Lamteng, TBB)	**13**
Total	**0**	**3**	**10**	**2**	**15**

Three key patterns emerge from the transition matrix. First, of the 13 districts initially classified in Tier 4 in 2023, nine advanced to Tier 3 and two leapt to Tier 2 (Kota Metro and Pesawaran), representing the only cases of multi-tier advancement. Second, two districts remained trapped in Tier 4 (Lampung Tengah and TBB), and no district reached Tier 1, indicating a ceiling effect at Tier 2. Third, the mobility index for advancement exceeding one tier is 13.3% (2/15), suggesting strong path dependency in digital maturity trajectories [19].

This finding is consistent with the theoretical expectation that organizational capacity, not mandate alone, determines adoption outcomes. The limited upward mobility observed in the transition matrix reinforces the interpretation that digital maturity patterns in Lampung Province are structurally persistent rather than transient.

4.2.4. Sigma-convergence test

Table 5 reports the sigma-convergence test results.

Table 5
Sigma-convergence test results, from 2023 to 2025

Indicator	2023	2024	2025	Trend	Conclusion
SD	0.36	0.42	0.39	↑ 8.3%	**Divergence**
Δ SD per period	–	+ 0.06	−0.03	Volatile	Not converging
CV (%)	14.2	14.3	12.3	Stable high	Persistent heterogeneity

Sigma-divergence is observed rather than convergence. The standard deviation increased from 0.36 in 2023 to 0.42 in 2024 before partially retracting to 0.39 in 2025, yielding a net increase of 8.3% over the period. The year-to-year pattern is volatile, with an increase of 0.06 followed by a decrease of 0.03, and does not exhibit a convergence trend as defined by declining dispersion over time.

This finding is important because it contradicts the implicit assumption in much of the e-government literature that mandatory adoption policies will eventually produce convergence as lagging entities catch up. In the Lampung case, the evidence suggests the opposite: dispersion widened despite aggregate progress. While the three-year observation window is relatively short and does not permit full long-term trajectory confirmation, the pattern remains internally consistent across multiple indicators, including the

standard deviation, coefficient of variation, gap stability, and the transition matrix, and therefore warrants serious diagnostic attention.

4.2.5. Trajectory clustering

Table 6 presents the K-Means clustering results (k = 4) based on three variables: mean SPBE score across three years, growth rate, and within-district volatility.

Table 6
Trajectory clustering results based on mean score, growth, and volatility

Cluster	Label	Mean Score	Growth Rate	Volatility	Members (N)
A	Digital Champions	3.21	32.1%	0.47	Metro, Pesawaran (2)
B	Steady Performers	3.49	11.2%	0.20	Mesuji, Way Kanan (2)
C	Gradual Improvers	2.78	32.9%	0.41	Bandarlampung, Lampung Selatan, Lampung Utara, Lampung Barat, Lampung Timur, Tanggamus, Tubang, Pesisir Barat (8)
D	Stagnant Districts	2.52	5.3%	0.07	Pringsewu, Lamteng, TBB (3)

The clustering yields four distinct trajectory profiles that are differentiated primarily by absolute maturity level rather than growth rate alone. Digital Champions (Cluster A: Metro, Pesawaran) are not defined by having the highest growth rate, since Cluster C's mean growth rate (32.9%) slightly exceeds Cluster A's (32.1%), but by combining high growth with a substantially higher absolute score (3.21 vs. 2.78).

This distinction matters because a district growing rapidly from a low base (Cluster C) faces different challenges from one growing at a comparable rate from an already elevated position (Cluster A): the former must still close a maturity gap, while the latter is approaching the performance frontier. The Steady Performers (Cluster B: Mesuji, Way Kanan) exhibit the highest absolute scores (3.49) but limited growth, suggesting a plateau effect. The Stagnant Districts (Cluster D: Pringsewu, Lamteng, TBB) exhibit minimal growth and low volatility (SD = 0.07), a pattern consistent with structural inertia [22] and constituting the primary target for intervention prioritization. The clustering typology will be integrated with the PemDi readiness profile in Section 4.4 to generate a more nuanced district classification that combines retrospective trajectory with prospective operational readiness.

4.3. PemDi readiness analysis (RQ2)

This section addresses Research Question 2: *What is the structural readiness profile of Digital Government (PemDi) across 15 districts, and what are the most critical provincial bottlenecks?* In contrast to Section 4.2, which examined historical SPBE trajectories, the present section provides a forward-looking diagnostic lens by mapping the current readiness conditions for broader Digital Government

transition in 2026. The analysis is organized into two components: readiness profiling by district and Provincial Priority Index analysis of the most critical bottlenecks.

4.3.1. Readiness profile per district

Table 7 presents the PemDi readiness scores across 15 districts in Lampung Province.

Table 7
PemDi readiness scores by district, 2026

District	Governance (/42)	Cybersecurity (/18)	Govt Services (/36)	Infrastructure (/24)	Total	%
Kota Metro	41	17	36	24	**118**	98.3
Pesawaran	37	18	33	24	**112**	93.3
Pesisir Barat	42	15	29	24	**110**	91.7
Way Kanan	35	15	33	20	**103**	85.8
Bandar Lampung	35	14	34	19	**102**	85.0
Tanggamus	33	11	33	20	**97**	80.8
Mesuji	32	10	32	22	**96**	80.0
Pringsewu	31	11	29	19	**90**	75.0
Lampung Utara	31	10	27	15	**83**	69.2
Lampung Barat	31	9	26	14	**80**	66.7
Lampung Selatan	21	14	29	16	**80**	66.7
Lampung Tengah	21	12	26	15	**74**	61.7
TBB	21	12	26	13	**72**	60.0
Tulang Bawang	24	6	26	14	**70**	58.3
Lampung Timur	19	9	26	12	**66**	55.0
Provincial Mean	30.3	12.2	29.7	18.1	**90.3**	75.2
% of Max Score	72.1%	67.8%	82.5%	75.4%	**75.2%**	-

The readiness profile reveals substantial inter-district inequality. Total readiness scores range from 66/120 in Lampung Timur (55.0%) to 118/120 in Kota Metro (98.3%), producing a gap of 52 points, equivalent to a 78.8% difference between the lowest and highest district scores. This range confirms that Lampung Province enters the PemDi transition from a highly uneven starting point rather than from a uniform baseline.

At the cluster level, Government Services emerges as the relatively strongest component, with a provincial mean of 29.7/36 or 82.5% of the maximum score. Infrastructure follows at 18.1/24 or 75.4%, while Governance records 30.3/42 or 72.1%. Cybersecurity is the weakest cluster, with a provincial mean of 12.2/18 or only 67.8% of the maximum score. This pattern is substantively important because it suggests that service-facing or formal compliance dimensions have generally advanced more rapidly than operational protection capabilities.

Within the Cybersecurity cluster, the most critical sub-category is Data Security (KS.2) [36], where 8 of 15 districts scored 0. This finding indicates that more than half of the districts lack basic operational mechanisms for data protection, such as encryption, access control, or data classification. In contrast, no district scored 0 in the Governance cluster, suggesting that formal policy and institutional arrangements are more developed than operational execution. This asymmetry is consistent with the design-reality gap described by Heeks [24], in which visible policy structures may advance faster than the less visible routines and capacities needed for sustained digital implementation.

The distribution of district scores also suggests that readiness should not be interpreted as a binary condition. Several districts occupy an intermediate zone, with moderate governance and service readiness but weak cybersecurity and infrastructure support. Accordingly, the readiness profile should be read as a differentiated spectrum of structural preparedness rather than as a simple distinction between “ready” and “not ready.”

4.3.2. Provincial priority index: Top-5 bottlenecks

To identify the most policy-relevant weaknesses, a Provincial Priority Index was constructed by counting the number of districts scoring 0 and 0–1 in each sub-category. Table 8 presents the Top-5 provincial bottlenecks.

Table 8
Top five provincial bottlenecks based on the Provincial Priority Index

Rank	Sub-Category	Districts Score = 0	Districts Score 0–1	Total Weak	Priority Band
1	KS.2 Data Security	8/15 (53%)	11/15 (73%)	73%	HIGH
2	IF.4.2 IT Ops/Helpdesk/SLA)	7/15 (47%)	12/15 (80%)	80%	HIGH
3	KS.3 Application Security	7/15 (47%)	11/15 (73%)	73%	HIGH
4	TG.5 HR Audit	6/15 (40%)	13/15 (87%)	87%	HIGH
5	LP.1 Application Lifecycle	6/15 (40%)	11/15 (73%)	73%	MEDIUM

Five provincial bottlenecks are identified, four of which fall within the HIGH priority band. The concentration of weaknesses in the operational-security dimension, including Data Security (73%), IT Ops/Helpdesk (80%), and Application Security (73%), suggests systemic rather than isolated deficiencies [20], [25] within this dataset.

4.4. Dual-lens integration: Joint display 2×2 (RQ3)

This section addresses Research Question 3: How does the integration of SPBE trajectory and PemDi readiness classify district typologies and reveal paradoxes that are not detected by conventional evaluations? Building on the longitudinal trajectory analysis in Section 4.2 and the structural readiness diagnosis in Section 4.3, this section integrates both lenses through a 2×2 joint display in order to generate district typologies with stronger diagnostic value than either lens can provide independently. The integration follows the merging logic outlined in the method section, where SPBE growth rate represents the retrospective execution signal and PemDi readiness score represents the prospective capability signal.

4.4.1. Joint display quadrant classification

Table 9 presents the quadrant classification resulting from the integration of SPBE trajectory and PemDi readiness. For analytical clarity, this study defines False Readiness as a condition in which a district shows relatively strong recent SPBE growth but still lacks the operational foundations required for substantive Digital Government implementation. By contrast, Execution Gap refers to a condition in which governance and readiness foundations are already relatively strong, yet actual SPBE progress remains slow.

Table 9
Dual-lens quadrant classification based on SPBE growth and PemDi readiness

Quadrant	Label	Districts	Growth (%)	Readiness (/120)	Risk Profile	Priority
A	*Champion*	Metro, Pesawaran, Tanggamus, Pesisir Barat, Bandar Lampung	28.5–66.0	97–118	Sustainability	Maintain
B	*False Readiness*	Tulang Bawang, Lampung Timur, Lampung Selatan, Lampung Barat	25.8–45.0	66–80	Data breach, downtime	High
C	*Execution Gap*	Mesuji, Way Kanan, Lampung Utara, Pringsewu	2.6–24.9	83–103	Stagnation	Medium
D	*Critical State*	Lampung Tengah, TBB	4.3–8.2	72–74	Structural collapse	Critical

The quadrant structure is based on the median cut-offs specified in Section 3.4.3, namely 25.8% for SPBE growth and 83/120 for PemDi readiness. Under this configuration, five districts fall into Quadrant A (Champion), four into Quadrant B (False Readiness), four into Quadrant C (Execution Gap), and two into Quadrant D (Critical State). This distribution shows that district performance in Lampung cannot be interpreted adequately through a single ranking or a single-year score because districts with similar apparent progress may occupy very different structural positions.

Figure 2 visualizes the joint display as a scatter plot, with SPBE growth rate (from 2023 to 2025) on the X-axis and PemDi readiness score (2026) on the Y-axis. The plot positions Quadrant A and Quadrant D at opposite corners, while Quadrants B and C occupy the off-diagonal spaces that represent mixed or paradoxical conditions. This off-diagonal configuration is analytically important because it reveals conditions that would remain hidden if trajectory and readiness were assessed separately.

4.4.2. Paradox diagnosis and typological meaning

The joint display suggests the presence of two paradoxes that are less visible through conventional single-lens evaluations. False Readiness (Quadrant B) is observed in four districts (Tulang Bawang, Lampung Timur, Lampung Selatan, and Lampung Barat), which show relatively high SPBE growth (25.8–45.0%) but still record low PemDi readiness scores (66–80/120). Within this quadrant, Lampung Timur is the most extreme case: it records 29.4% growth yet has the lowest PemDi readiness score in the province, at 66/120. In the draft diagnosis, this pattern is linked to weak operational foundations, including a score of 0 in Data Security and 0 in Helpdesk/SLA, which indicates that visible digital progress may coexist with fragile implementation capacity. This configuration is consistent with what Heeks [24] characterizes as an e-government façade, where formal progress indicators improve faster than the operational capabilities needed to sustain them.

The second paradox is Execution Gap (Quadrant C), where Mesuji, Way Kanan, Lampung Utara, and Pringsewu show relatively strong readiness foundations (83–103/120) but limited SPBE growth (2.6–24.9%). This pattern suggests that the presence of governance structures, service readiness, or infrastructure does not automatically translate into recent execution momentum. In other words, some districts appear institutionally prepared but operationally slow, indicating that the bottleneck may lie not in readiness absence but in activation, delivery discipline, or implementation follow-through.

Quadrant D (Critical State) contains only two districts, Lampung Tengah and TBB, yet it represents the most severe intervention category because both trajectory and readiness are simultaneously low. Their growth rates remain at only 4.3% and 8.2%, while readiness scores remain at 74 and 72 out of 120, respectively. This combination suggests structural incapacity rather than a temporary fluctuation, although that interpretation should remain bounded by the relatively short observation window used in this study.

Quadrant A (Champion) includes Metro, Pesawaran, Tanggamus, Pesisir Barat, and Bandar Lampung. These districts combine relatively high growth (28.5–66.0%) with high readiness (97–118/120), indicating that recent SPBE progress is supported by stronger forward-looking capability conditions. Even so, this quadrant should not be interpreted as “fully complete” in an absolute sense, but rather as the most advanced group within the bounded Lampung dataset. Taken together, the integrated result shows that similar growth rates do not imply similar readiness conditions, and similar readiness scores do not imply similar execution trajectories. This is the key added value of the dual-lens design: it converts two separate descriptive datasets into a typological diagnosis with direct intervention relevance. In practical terms, the joint display functions as a diagnostic filter that distinguishes districts requiring maintenance, correction, acceleration, or emergency support.

The analytical significance of this section extends beyond local classification. In the Lampung context, the joint display provides initial evidence that mandatory adoption environments may produce not only divergence in aggregate dispersion, but also mismatches between formal progress and substantive readiness. This finding strengthens the argument developed in the previous sections that regulatory pressure alone does not guarantee convergent capability formation across districts. The next section therefore translates these district typologies into a structured Three-Layer Digital Convergence Framework for differentiated intervention design

4.5. Three-layer digital convergence framework

Synthesizing the findings from RQ1 to RQ3, this study proposes a Three-Layer Digital Convergence Framework that translates diagnostic evidence into a structured intervention architecture. The framework is organized into three sequential layers: Governance, Resources, and Technical. This sequencing reflects the empirical finding that governance foundations must precede resource mobilization, and that sufficient resources are a prerequisite for effective technical implementation.This sequencing is consistent with the argument of Pardo and Burke [30] that governance capability functions

as a prerequisite, not merely a complement, to technical capability, and it also aligns with the COBIT distinction [20] between governance objectives and management objectives.

Rather than treating all districts as if they face the same transition problem, the framework differentiates intervention logic according to the quadrant typology generated in Section 4.4. This differentiation is necessary because the dual-lens analysis shows that high growth does not always indicate readiness, and high readiness does not always translate into execution. Accordingly, the purpose of the framework is not to impose a uniform modernization template, but to guide convergence through sequenced and typology-specific intervention.

4.5.1. Three-layer architecture

Table 10 presents the structure of the Three-Layer Digital Convergence Framework. The architecture is layered from foundation to execution: Layer 1 addresses governance alignment, Layer 2 addresses enabling resources, and Layer 3 addresses operational and technical implementation. This ordering reflects the central diagnosis of the study that uneven digital outcomes in Lampung are not driven by technology alone, but by the interaction of institutional coordination, resource capacity, and operational capability.

Table 10
Three-Layer Digital Convergence Framework

Layer	Focus	Quadrant A (Champion)	Quadrant B (False Readiness)	Quadrant C (Execution Gap)	Quadrant D (Critical State)
L1: Governance	Policy architecture, institutional coordination, HR audit	Maintain; serve as provincial mentor	**Freeze** current digitization; conduct governance gap audit	Audit why strong governance has not translated to execution	Emergency governance twinning with Quadrant A district
L2: Resources	IT budget, human capital, training pipeline	Sustain investment; develop knowledge-sharing platform	Reallocate budget from expansion to security and operations capacity	Unlock stalled budget execution; deploy change agents	Provincial emergency fund allocation; shared-service model
L3: Technical	Data security, Helpdesk/SLA, application lifecycle, interoperability	Pilot advanced integration, including Satu Data and interoperability	Implement data security and helpdesk functions before introducing new systems	Accelerate technical deployment using existing strong foundations	Establish minimum viable infrastructure first, including data security and basic helpdesk support

The core logic of Table 10 is sequential rather than additive. Districts are not expected to improve all dimensions at the same speed; instead, each quadrant follows a different entry point into the same layered architecture. In this sense, the framework is designed to reduce divergence not by equalizing outcomes immediately, but by equalizing the sequence of foundational capability development.

4.5.2. Typology-based intervention logic

Quadrant B (False Readiness) constitutes the most urgent policy priority within the framework. Recommended action: freeze and fix by halting further digital expansion until a governance audit and basic operational safeguards, especially data security and helpdesk functions, are in place.This recommendation is empirically grounded in cases such as Lampung Timur, where a 29.4% SPBE growth rate coexists with the province's lowest PemDi readiness score and operational weaknesses such as Data Security = 0 and Helpdesk/SLA = 0. The diagnostic implication is that visible progress without operational protection may deepen fragility rather than strengthen digital maturity.

Quadrant D (Critical State) requires the most intensive intervention because both trajectory and readiness are simultaneously weak. In the present diagnosis, this category includes Lampung Tengah and TBB, and the proposed response is a combined emergency mechanism consisting of governance twinning, provincial support, and shared-service IT operations. This approach reflects the interpretation that these districts face structural incapacity for autonomous catch-up under normal conditions. Because the evidence is bounded to one province and a short period of observation, this should be read as a strong diagnostic signal rather than as a deterministic claim.

Quadrant C (Execution Gap) requires a different strategy. These districts already possess relatively stronger readiness foundations, but recent SPBE execution remains slow, so the framework prioritizes activation rather than rescue. The main emphasis is on Layer 2 interventions, particularly unlocking stalled budget execution and deploying change agents, before accelerating Layer 3 implementation. The underlying assumption is that capability exists in partial form but is not yet being translated into delivery momentum.

Quadrant A (Champion) shifts from being the primary recipient of intervention to becoming a provider of provincial capacity. The framework assigns these districts a mentoring and demonstration role, including knowledge-sharing, provincial mentoring, and participation in advanced interoperability pilots such as Satu Data integration. In this way, the most advanced districts are positioned not only as local success cases, but also as operational anchors for province-wide convergence.

4.5.3. Bridge to roadmap

To translate the framework into an implementation sequence, this study proposes a phased timeline and KPI structure for 2026–2028. Table 11 summarizes the indicative phases, which move from stabilization, to activation, to integration. The table does not function as a rigid blueprint, but as an evidence-informed bridge between diagnostic typology and provincial action planning.

Table 11
Indicative implementation timeline and KPIs, 2026–2028

Phase	Period	Focus	KPI
Phase 1: Stabilize	2026 (6 months)	L1 governance audit and L3 data security for Quadrants B and D	100% districts with Data Security score ≥ 1; governance audit completed
Phase 2: Activate	2026–2027 (12 months)	L2 resource mobilization for Quadrants C and D; L3 Helpdesk/SLA for all districts	100% districts with Helpdesk/SLA score ≥ 1; change agents deployed in Quadrant C
Phase 3: Integrate	2027–2028 (12 months)	L3 interoperability pilot in Quadrant A; province-wide data dictionary	Satu Data pilot operational in at least 3 districts; SD reduction from baseline

The phased structure of Table 11 reinforces the central argument of the framework: convergence should begin with minimum safeguards and institutional discipline before moving toward province-wide integration. This means that interoperability and advanced integration are treated as later-stage outcomes, not as starting assumptions. The sequencing is especially important in a province where security, helpdesk, and HR audit weaknesses remain widespread across districts.

Overall, the Three-Layer Digital Convergence Framework should be understood as an evidence-informed policy instrument rather than a prescriptive blueprint. Its value lies in converting the study's diagnostic findings into a structured intervention logic that is differentiated, sequential, and operationally actionable.

4.6 Discussion

The findings indicate that the digital transition of districts in Lampung Province is characterized not simply by uneven performance but by a patterned form of divergence that remains visible across multiple analytical lenses. At the trajectory level, the province shows aggregate SPBE improvement but not convergence, as dispersion remains high and upward mobility is limited. At the readiness level, substantial inequality also persists, particularly in cybersecurity and operational support functions. When both lenses are integrated through the joint display, the resulting typologies reveal that recent SPBE progress and underlying Digital Government readiness do not always move in the same direction.

This pattern strengthens confidence that the divergence observed in Lampung is not an artifact of a single indicator. The interpretation is supported by several mutually reinforcing signals: complete and temporally stable SPBE data, limited inter-tier mobility, distinct clustering patterns, a 52-point readiness gap across districts, and stable quadrant membership under alternative reconciliation choices. Taken together, these findings suggest that widening disparity is not merely a temporary fluctuation but a recurring diagnostic pattern within the bounded Lampung dataset.

Theoretically, these findings extend the boundary conditions of Rogers' diffusion of innovations theory in a mandatory adoption context. Classical diffusion logic is often associated with eventual catch-up among lagging adopters; however, the Lampung case suggests that mandatory digital reform does not

automatically produce convergence when districts begin from highly unequal institutional and operational positions. In this setting, formal adoption pressure appears insufficient to overcome underlying asymmetries in governance capacity, fiscal space, human resources, and technical preparedness.

The findings are also consistent with cumulative advantage and path dependency perspectives. Districts with stronger initial conditions appear better positioned to translate policy mandates into sustained improvement, whereas weaker districts remain constrained even when formal compliance pressure is shared across all jurisdictions. This interpretation aligns with Van Dijk's cumulative advantage framework [7] and Merton's Matthew Effect [8], both of which help explain why aggregate progress may coexist with widening inequality. It also resonates with Fountain's technology enactment perspective, which emphasizes that public-sector technology is enacted through existing institutional structures rather than implemented in a neutral organizational vacuum [22].

A second theoretical contribution lies in the integration of trajectory and readiness as a coupled diagnostic configuration. Much of the existing SPBE and e-government literature in Indonesia remains cross-sectional, while readiness frameworks are often applied without being linked to observed multi-year performance trajectories. By combining retrospective trajectory analysis and prospective readiness assessment through a joint display, this study shows that districts with similar growth rates may face very different structural conditions, and that districts with similar readiness scores may exhibit very different execution outcomes. Digital maturity, therefore, is better understood not as a linear progression but as an interaction between historical movement and forward-looking capability.

The discussion also refines the design-reality gap perspective. In this study, the gap is visible not only within individual organizations but also across districts within the same province. The False Readiness pattern suggests that visible score improvement may outpace operational protection, whereas the Execution Gap pattern shows that governance and readiness foundations do not automatically translate into implementation momentum. This implies that misalignment in digital government should be examined not only within agencies but also across territorial units facing unequal capacities and constraints.

In relation to prior literature, the Lampung case is broadly consistent with studies documenting persistent digital inequality at both the international and Indonesian levels. Aumeboonsuke [11] and Abd Rashid et al. [35] show that digital progress does not necessarily imply convergence across countries, while Yulianto and Khairunnisa [12] identify enduring heterogeneity across Indonesian provinces. The present study contributes by demonstrating that a similar logic of divergence can also be observed at the intra-provincial district level and that such divergence can coexist with readiness paradoxes that are less visible under single-lens evaluation. In this sense, the study adds a more granular sub-national diagnosis to the broader debate on digital convergence and uneven institutional adaptation.

The findings also carry an important interpretive implication for assessment architecture. Aggregate improvement scores, when read in isolation, may overstate substantive progress because they can

conceal operational fragilities in areas such as data security, helpdesk continuity, application security, and HR audit. The Lampung evidence therefore supports the use of weakest-link diagnostics alongside aggregate performance indicators, especially in mandatory reform settings where visible compliance may advance faster than resilient implementation capacity.

This point is particularly relevant to the transition from SPBE to broader Digital Government, where interoperability and service integration depend on minimum operational reliability across all districts.

Even so, the interpretation of this study remains bounded. The observation window for SPBE trajectory covers only three years, the readiness assessment is cross-sectional and partly input-oriented, and the case is limited to a single province. Accordingly, the study does not claim causal inference or broad external generalizability. Instead, its contribution lies in providing a strong descriptive-comparative diagnosis supported by complete official data, sensitivity checks, and integrated typological analysis. Within these limits, the evidence suggests that mandatory digital adoption, when not accompanied by sufficient institutional capacity, may deepen divergence rather than reduce it.

5. Policy and practical implications

The findings of this study have practical relevance because they translate diagnostic evidence into differentiated intervention priorities for the transition from SPBE to Digital Government. Rather than treating all districts as if they face the same problem, the results suggest that policy responses should be calibrated to the specific combination of trajectory and readiness identified through the joint display. In this sense, the value of the study lies not only in describing Lampung's digital condition but also in clarifying how provincial and national actors can respond more effectively to uneven institutional capacity.

5.1. Implications for provincial government

For the Provincial Government of Lampung, the main implication is that convergence policy should be differentiated rather than uniform. The quadrant classification shows that districts in the Champion, False Readiness, Execution Gap, and Critical State categories face different combinations of trajectory and readiness and therefore should not receive the same intervention package. Provincial coordination should move away from one-size-fits-all compliance monitoring toward typology-based support, phased sequencing, and more targeted resource allocation.

In operational terms, districts in Quadrant A should be positioned as mentoring and demonstration sites rather than as the primary recipients of corrective intervention. Districts in Quadrant B require a freeze-and-fix sequence, meaning that digital expansion should pause until minimum safeguards in governance, data security, and helpdesk continuity are established. Districts in Quadrant C require activation support, particularly in budget execution, change-agent deployment, and delivery discipline. Districts in Quadrant D require emergency support through stronger provincial coordination, governance twinning, and shared-service arrangements.

The provincial government also needs to treat minimum operational capability as a convergence floor. The findings suggest that security, helpdesk continuity, HR audit, and application lifecycle management should be addressed as province-wide priorities before more advanced interoperability ambitions are scaled. This implies that the provincial roadmap should begin with stabilization and activation, and only then move toward broader integration initiatives.

5.2. Implications for district governments

For district governments, the central implication is that visible digital expansion should not proceed ahead of minimum operational safeguards. Districts with improving SPBE scores may still remain vulnerable if data security, helpdesk functions, and workforce oversight remain weak. Accordingly, local digital strategies should prioritize resilience and operational continuity before the introduction of new applications or service channels.

Districts in the False Readiness category should focus first on correcting underlying fragilities. This means conducting governance and operational audits, reallocating budgets from symbolic expansion to essential controls, and ensuring that basic security and support functions are fully operational. In these districts, the immediate policy objective is not to maximize the number of digital initiatives but to make existing initiatives sustainable and defensible.

Districts in the Execution Gap category should focus on converting existing readiness into measurable delivery. Their main challenge is not the absence of foundational capacity but the slow activation of that capacity into implementation momentum. For these districts, the policy emphasis should be on leadership follow-through, budget absorption, implementation discipline, and the targeted deployment of internal change agents.

Districts in the Critical State category should not be expected to catch up autonomously within the same time horizon as stronger districts. For these districts, realistic progress depends on external support, simplified priorities, and minimum viable capability targets. A staged approach is therefore more appropriate than broad reform agendas that exceed local implementation capacity.

5.3. Implications for central government and assessment architecture

The findings also have implications for central institutions responsible for SPBE and Digital Government governance. A single aggregate improvement score may mask substantial operational fragility, especially when districts show recent progress but continue to perform weakly in security, operational support, and institutional readiness. This suggests that the national assessment architecture should complement aggregate scoring with weakest-link diagnostics in areas such as data security, helpdesk continuity, application security, and HR audit.

More broadly, the transition from SPBE to Digital Government may require a shift from compliance-only oversight to convergence-oriented governance. In contexts of strong regional heterogeneity, mandatory

standards alone may reproduce divergence if they are not accompanied by differentiated support instruments. These instruments may include targeted fiscal assistance, provincial shared-service models, technical mentoring, and intervention pathways linked to district typology rather than to uniform reporting requirements.

The findings also support a more sequenced national transition logic. Districts should not be pushed toward advanced interoperability and integration targets before they achieve minimum operational reliability. In practical terms, this means that the central government may need to align SPBE evaluation, Digital Government transition policy, and Satu Data implementation around staged capability thresholds rather than assuming that all local governments are equally prepared to move at the same pace.

6. Conclusion

This study examined the transition from SPBE to Digital Government across 15 districts and municipalities in Lampung Province by integrating longitudinal SPBE trajectory analysis (2023–2025) with a cross-sectional PemDi readiness assessment (2026). The findings show that the province experienced aggregate SPBE improvement but not convergence. Although the mean SPBE score increased over the observation period, inter-district disparity remained substantial, upward mobility was limited, and sigma-divergence rather than sigma-convergence was observed.

The readiness analysis further shows that Lampung's digital transition is constrained by uneven structural capacity. Readiness scores varied widely across districts, and the most critical bottlenecks were concentrated in operationally foundational areas such as data security, helpdesk and service continuity, and related enabling capabilities.

By integrating trajectory and readiness through a 2×2 joint display, the study identified four district typologies—Champion, False Readiness, Execution Gap, and Critical State—and showed that historical performance and forward-looking readiness do not always move in the same direction. This integrated diagnosis provides a more discriminating interpretation than single-lens evaluation because it reveals paradoxes that remain hidden when districts are assessed only through aggregate performance scores or only through readiness conditions.

Based on these findings, the study proposes a Three-Layer Digital Convergence Framework consisting of Governance, Resources, and Technical layers, accompanied by a differentiated 2026–2028 roadmap. The framework contributes practically by translating diagnostic evidence into a sequenced intervention logic, methodologically by combining longitudinal trajectory analysis with readiness integration at the district level, and theoretically by showing that mandatory digital reform does not automatically produce convergence under conditions of uneven institutional capacity.

These conclusions should be interpreted within the limits of the study. The SPBE trajectory covers a relatively short three-year period, the readiness assessment is cross sectional, and the empirical scope is bounded to a single province. Accordingly, the study does not claim causal inference or broad national

generalizability. Future research should extend the observation period, replicate the design in other provinces, and examine whether similar patterns of divergence and readiness paradoxes emerge across different institutional settings.

Declarations

Funding

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Competing interests

The authors declare no competing interests, financial or non-financial, that could have influenced the design, conduct, or reporting of this study. Funding was received from LPDP (disclosed above), which had no involvement in research decisions or manuscript preparation.

Ethics approval and consent to participate

This study analyzed secondary official government evaluation data from public administrative sources (PANRB SPBE evaluation results and provincial Diskominfo readiness data) and did not involve direct experimentation with human subjects. Confirmatory interviews were conducted with government officials in their professional capacity. All participants provided informed verbal consent, and no personally identifying information is reported. Formal ethics committee review was not required under the applicable institutional research regulations of Universitas Indonesia for studies based on archival administrative data and professional interviews. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki where applicable.

Consent for publication

Not applicable. No personally identifying information or images of individuals are included in this manuscript.

Author Contribution

Author contributionsKevin Andre Jonathan: Conceptualization; Methodology; Formal analysis; Data curation; Investigation; Visualization; Writing – original draft; Writing – review & editing.Achmad Nizar Hidayanto: Conceptualization; Supervision; Project administration; Writing – review & editing.Chairote Yaiprasert: Conceptualization; Supervision; Writing – review & editing.

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Data Availability

The datasets analyzed in this study comprise: (1) official SPBE evaluation reports for 2023–2025 published by the Ministry of Administrative and Bureaucratic Reform (Kementerian PANRB, cited in references [4]–[6]); (2) a 2026 Digital Government (PemDi) readiness dataset compiled from Lampung provincial Diskominfo sources; (3) supporting fiscal and IT human resources data from district BPKD/DJPK and Diskominfo offices; and (4) anonymized contextual interview materials. Publicly available SPBE evaluation reports are accessible via the PANRB official website and are cited in the reference list. The compiled PemDi readiness dataset and supporting administrative data are not publicly deposited because they were obtained from government institutions under research access agreements and may contain institution-level operational information; however, these materials are available from the corresponding author upon reasonable request and subject to written permission from the respective institutional data custodians. Interview materials are not shared publicly in order to preserve participant anonymity, consistent with the consent granted by participants.

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Figures

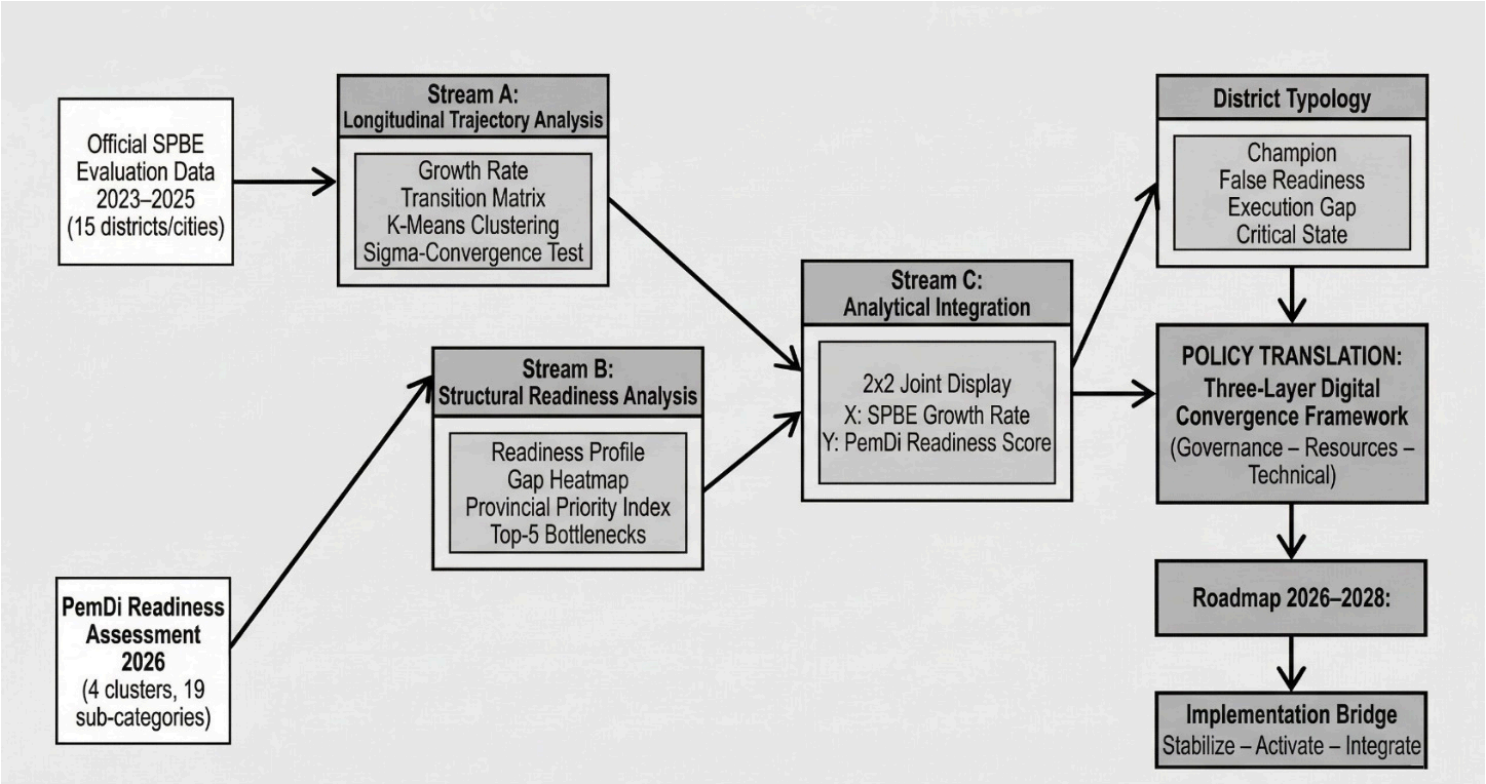


Figure 1

Research design and analytical integration flow of the study

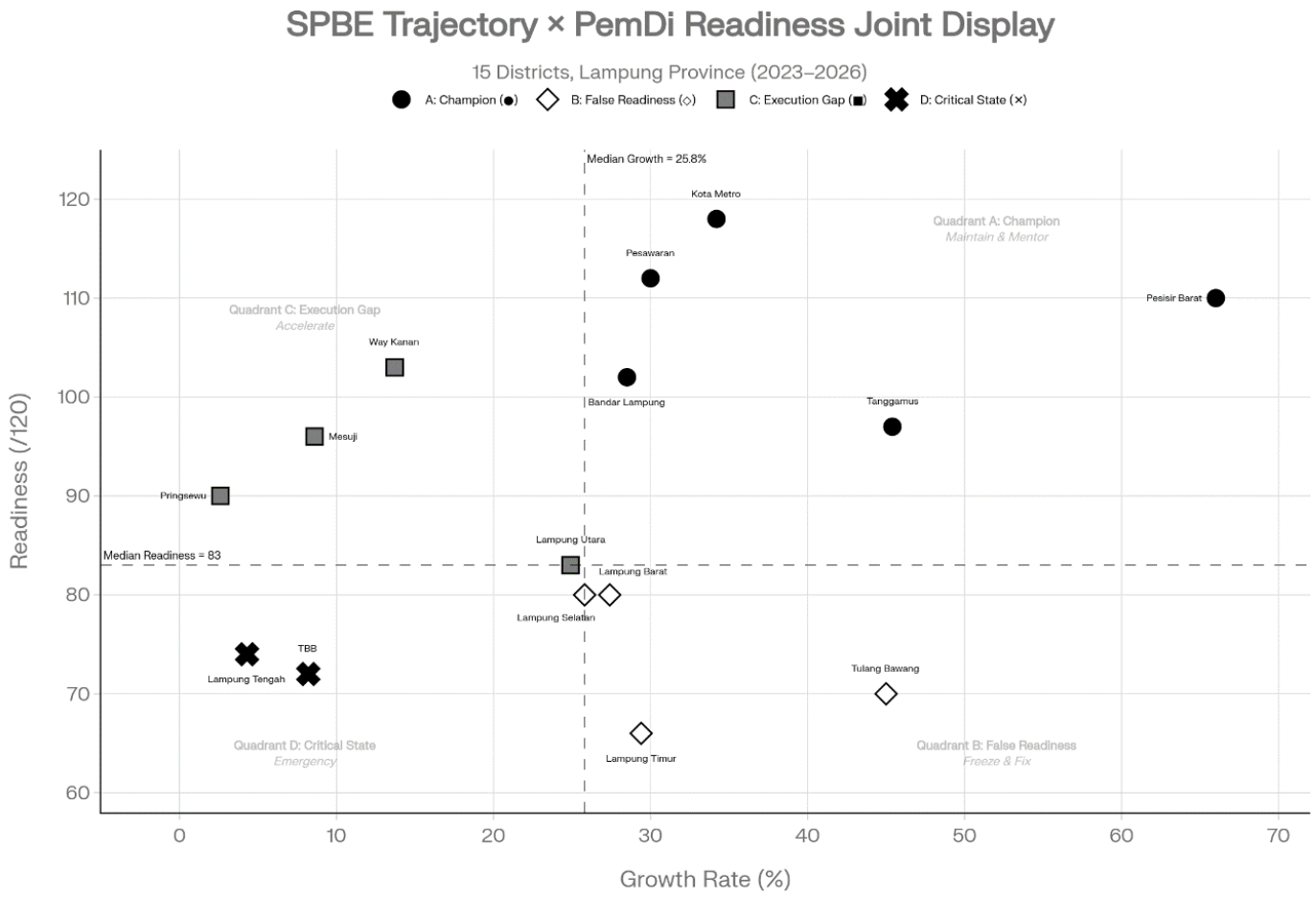


Figure 2

Joint-display scatter plot of district SPBE growth rates (from 2023 to 2025) and PemDi readiness scores (2026) in Lampung Province. Dashed lines indicate the median cut-offs used to define the four diagnostic quadrants: growth rate = 25.8% and readiness score = 83/120.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- AppendixA.docx