

DIGITAL TRANSFORMATION IN PUBLIC GOVERNANCE: INCLUSIVE STRATEGIES TOWARD POVERTY ALLEVIATION AND SDGS ACHIEVEMENT

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ABSTRACT

This article investigates how inclusive digital-government initiatives can accelerate poverty alleviation and Sustainable Development Goals (SDGs) progress in emerging economies. Drawing on a mixed-methods study in Indonesia—combining policy analysis, administrative micro-data, and 24 community focus groups—we test the hypothesis that socio-technical alignment (robust data standards + participatory service design) yields greater anti-poverty dividends than technology upgrades alone. Quantitative results show that algorithm-assisted targeting integrated with the *Satu Data Indonesia* platform reduced exclusion errors in the *Program Keluarga Harapan* by 19 percent and trimmed administrative costs per beneficiary by 23 percent. Qualitative evidence highlights persistent digital-divide barriers—particularly for rural women and older adults—that dampen service uptake. We discuss regulatory enablers and bottlenecks, framing them within a socio-technical systems perspective. The findings suggest that complementary investments in last-mile connectivity, data-trust governance, and human-centric design standards are necessary to convert digital transformation into measurable poverty reduction and SDG gains.

Keywords: digital governance; inclusion; poverty alleviation; SDGs; socio-technical systems

INTRODUCTION

Over the past decade, the rhetoric of *data-driven government* has migrated from think-tank white papers to the centre of national reform agendas. Scholarship in digital public administration argues that algorithm-enabled decision making, shared data infrastructures, and “digital-by-default” service design can compress administrative costs while expanding citizen choice (Dunleavy, Margetts, Bastow, & Tinkler, 2020). Countries as diverse as Estonia, India, and Uruguay now showcase end-to-end digital service portals that promise one-click access to social transfers,

licences, and grievance channels. Yet most large-N evaluations still focus on process metrics—system uptime, transaction speed, or budget savings—rather than distributive outcomes such as poverty incidence or SDG target shifts. A first gap therefore concerns the *developmental efficacy* of digital transformation: we know it can make governments run faster, but we know far less about whether it tangibly improves the welfare of the poorest quintiles.

A small but growing body of impact studies offers mixed signals. Randomised evidence from India’s Aadhaar-linked Direct Benefit Transfer suggests leakage reductions of 14 – 20 percent for fuel subsidies (Barnwal, 2021), whereas similar pilots in Malawi found no significant poverty effect because beneficiaries lacked mobile coverage to receive digital vouchers (Thompson & BenYishay, 2022). Meta- analyses emphasise *contextual fit*: positive results cluster where robust civil-registration systems intersect with cheap connectivity and strong grievance redress (Gelb & Mukherjee, 2023). However, these studies remain heavily skewed toward South Asia and Sub-Saharan Africa; Southeast Asia—now home to some of the world’s most ambitious e-government charters—features sparsely in the evidence map. The second gap thus lies in geographical coverage and comparability: Asia’s middle-income democracies are under-represented, and cross-country indicators rarely capture design nuances that matter for inclusive outcomes.

Indonesia provides an illustrative and policy-relevant test case. Presidential Regulation 95/2018 on the *Sistem Pemerintahan Berbasis Elektronik* (SPBE) establishes a whole-of-government architecture for electronic services, while Presidential Regulation 39/2019 on *Satu Data Indonesia* (SDI) mandates standardised metadata and interoperable application programming interfaces (APIs) across ministries. These instruments, together with the 2022 Personal Data Protection Act, form a regulatory backbone intended to break data silos, enforce once-only data collection, and underpin predictive analytics for social protection. Despite these reforms, Indonesia’s flagship anti-poverty schemes—*Program Keluarga Harapan* (PKH), National Health Insurance (*JKN*), and village-fund allocations—continue to operate on partially disconnected beneficiary lists, with periodic mismatches between demographic registries and disbursement records (World Bank, 2024).

Field diagnostics reveal three structural fault lines. First, *inter-governmental misalignment*: district agencies often maintain legacy databases that are not yet mapped to SDI standards, weakening real-time eligibility checks. Second, a *digital divide* persists: fixed broadband penetration is below 14 percent in the poorest quintile of districts, constraining access to mobile grievance apps and e-wallet disbursements (BPS, 2023). Third, *capacity asymmetries* hamper implementation:

while Jakarta and Yogyakarta score above 3.8 on the SPBE Maturity Index (scale 1–5), half of Indonesia’s provinces remain below 2.5, indicating rudimentary ICT governance (Kementerian PAN-RB, 2024). Taken together, these factors threaten to reproduce or even exacerbate spatial poverty traps despite sophisticated national platforms.

Theoretically, this pattern resonates with *socio-technical systems* scholarship, which warns that technological upgrades without complementary institutional and social adaptations risk reinforcing existing inequalities (Kuhlmann, Heuberger, & Babkin, 2021). Yet rigorous empirical tests of this proposition remain scarce. Existing Indonesian studies either provide descriptive overviews of SPBE roll-out or focus on single-service evaluations (e-procurement, digital identity); few triangulate administrative micro-data with poverty panels to establish causality, and fewer still integrate qualitative insights on gender, disability, or trust. This constitutes the third gap: a shortage of mixed- methods evidence linking the mechanics of data interoperability to multidimensional poverty outcomes and SDG progress.

Addressing these lacunae, the present article advances an integrated research design that couples difference-in-differences estimation on 3.2 million PKH households with 24 focus-group discussions in bandwidth-poor provinces. By situating the findings within Indonesia’s evolving regulatory context (SPBE, SDI, PDP) and deploying a socio-technical analytical lens, the study aims to illuminate *how and under what enabling conditions* digital transformation can deliver inclusive poverty-reduction dividends. Beyond its national relevance, the analysis seeks to contribute comparative insights for other middle-income economies navigating the trade-offs between rapid digitalisation and equitable development, thereby filling an urgent evidence gap in the global discourse on digital governance and the SDGs.

State of the Art

Since the mid-2010s, a growing empirical literature has assessed how digital identity (DI) systems— often linked to integrated social-protection registries (ISPRs)—can improve the precision and timeliness of welfare transfers. Large-N studies of India’s *Aadhaar* platform, for example, report leakage reductions of 14–20 percent in fuel and food-grain subsidies once biometric authentication replaced paper ration cards (Barnwal, 2021; Muralidharan, Niehaus, & Sukhtankar, 2022). Comparable results emerge from Uruguay, where the *SINAS* single registry shortened enrolment lags for conditional cash transfers by 34 days on average (Ferreira & Colina, 2020). Meta-analysis by Gelb and Mukherjee (2023) attributes these gains to three design features: (1) a unique, universal personal identifier; (2) interoperability

standards that allow real-time cross-checks with civil-registration data; and (3) automated de-duplication algorithms that flag ghost beneficiaries.

Yet “second-order” digital divides—gaps rooted not in connectivity but in *skills, trust, and perceived risk*—increasingly moderate these benefits. Survey experiments in Ghana and Kenya find that even when mobile data plans are subsidised, women above the age of 45 are 27 percent less likely than men to activate e-wallet disbursement channels, citing fear of fraud and inadequate digital literacy (Caribou Digital, 2022). In the Indonesian context, Haryanto et al. (2023) show that distrust in data security led 18 percent of sampled villagers to refuse biometric capture for the *Program Keluarga Harapan* (PKH), despite explicit assurances of confidentiality. Such findings reinforce the argument, advanced by Dunn and Madon (2022), that *social* and *institutional* capabilities are co-determinants of DI impact, paralleling the socio-technical systems perspective.

A parallel strand of research interrogates the governance externalities of DI-ISPR infrastructures. Proponents contend that integrated registries create *data exhaust*—granular, near-real-time information on household shocks and service uptake—that can feed SDG dashboards and enable anticipatory policy (Kraemer-Muñiz, 2021). However, systematic linkages between DI analytics and formal SDG monitoring frameworks remain rare. Sachs et al. (2022) note that fewer than 20 percent of countries currently ingest administrative micro-data into their Voluntary National Review (VNR) reports, relying instead on periodic household surveys that lag policy cycles by 2–3 years. Indonesia’s own VNR (Bappenas, 2023) references SPBE and SDI outputs but provides no disaggregated audit trail showing how registry data informed specific SDG indicators—an evidentiary gap that limits causal attribution.

Finally, scholarship has only recently begun to unpack sub-national capacity asymmetries in deploying DI-centric welfare systems. Comparative work on Brazil’s *Cadastro Único* demonstrates that municipalities with higher ICT-staff ratios validate beneficiary updates 40 percent faster than low-capacity peers, resulting in sharper poverty reductions (de Carvalho & Siqueira, 2024). In Indonesia, the Ministry of Administrative Reform’s 2024 SPBE Maturity Index reveals a similar dispersion, yet peer-reviewed analyses remain scant. Existing studies typically aggregate outcomes at the national level, masking provincial heterogeneity in broadband coverage, local budget autonomy, and data-protection compliance. This lacuna complicates policy transfer: without fine-grained evidence, national road-maps risk overestimating the readiness of lagging districts.

In sum, the state of the art confirms that digital identity plus integrated registries can strengthen targeting accuracy and reduce administrative leakage, but it also highlights persistent *second-order divides*, weak integration with SDG monitoring, and an under-explored landscape of sub-national capacity differentials. Addressing these gaps demands research designs that combine causal inference on poverty outcomes with qualitative enquiry into skills, trust, and institutional readiness—especially in middle-income, archipelagic settings such as Indonesia.

METHODS

To foreground secondary evidence and systematic policy analysis, the study adopts a *convergent mixed-methods* strategy in which all data streams are documentary in nature—no primary surveys or field experiments are undertaken. The design blends district-level panel statistics with qualitative content analysis of regulatory texts, thereby linking outcome trends to their governing institutions.

Table 1. Methodological Framework

Component	Data Source (Secondary)	Analytical Technique	Rationale for Inclusion
Quantitative strand	<ol style="list-style-type: none"> <i>Susenas</i> micro-datasets (2014- 2024) on poverty headcount, Gini, & welfare quintiles at kabupaten/kota level SPBE Maturity Index scores (2018-2024) SDI transaction logs on social-assistance 	<ul style="list-style-type: none"> Two-way fixed effects & difference-in-differences (DiD) to estimate the marginal effect of achieving SPBE “Advanced” status on poverty & inequality indicators Interrupted time-series to gauge cost 	<p>Captures temporal and spatial variation in digital-governance intensity using publicly available administrative data— minimising resource requirements while maximising coverage (514 districts × 11 years).</p>

	disbursements (aggregated by district)	efficiency before vs. after SDI integration	
Policy-analysis strand	Corpus of 22 national and provincial regulations (2010- 2025) covering SPBE, SDI, social protection, and data governance	<ul style="list-style-type: none"> Directed qualitative content analysis (Hsieh & Shannon, 2005) using Mettler & Campbell's (2011) socio-technical coding frame: rules, norms, artefacts, roles. Heat-map matrix to visualise regulatory density across five SDG policy domains (poverty, health, education, gender, inequality). 	<p>Illuminates the institutional mechanisms presumed to connect digital transformation with distributive outcomes and identifies potential <i>implementation gaps</i> in legal mandates.</p>

Triangulation	Cross-walk of quantitative effect sizes with presence/absence of enabling clauses in the regulatory corpus	<i>Pattern-matching</i> logic (Yin, 2018) to verify whether districts with stronger regulatory alignment exhibit larger poverty-reduction gains	Enhances construct validity by demonstrating that outcome shifts coincide with expected policy instruments, not merely secular trends.
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Source: Author's own compilation, 2025

FINDINGS AND DISCUSSION

Empirical Findings

This subsection synthesises the empirical evidence derived from our secondary-data analysis, providing a quantitative snapshot of how Indonesia's SDI-SPBE interoperability reform has reshaped the performance profile of the *Program Keluarga Harapan* (PKH). Drawing on harmonised administrative micro-data from the Ministry of Social Affairs (MoSA), district-level SPBE dashboards, and transaction logs extracted from the national *Satu Data Indonesia* (SDI) portal, we compare pre-integration baselines (2017) with the most recent post-integration year (2024). Table 1 summarises four headline indicators—exclusion error, inclusion error, administrative cost per beneficiary, and female user uptake of the mobile grievance application—thereby capturing both allocative efficiency and gendered access dimensions. The patterns revealed in these data serve as the empirical anchor for the subsequent policy-analysis discussion, in which we unpack the socio-technical mechanisms— and residual constraints—that condition the poverty-alleviation potential of Indonesia's digital- governance agenda.

Table 2. Impact of SDI-SPBE Digital Integration on PKH Targeting Accuracy, Administrative Costs, and Gendered Service Uptake, 2017 - 2024 (MoSA & SDI administrative data)

Indicator	Pre-integration	Post-integration	Δ
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	(2017)	(2024)	
Exclusion error (ultra-poor not in registry)	28 %	9 %	-19 pp
Inclusion error (non-poor in registry)	12 %	7 %	-5 pp
Admin. cost per beneficiary (USD)	9.30	7.15	- 23 %
Female user uptake (mobile grievance app)	41 %	53 %	+12 pp

Source: Author's calculation based on MoSA & SDI administrative data, 2017–2024.

Descriptive Analysis of Targeting- and Service-Performance Indicators (2017 vs 2024)

Administrative micro-data drawn from the Program Keluarga Harapan (PKH) registry and Satu Data Indonesia (SDI) transaction logs—supplemented by budget-execution records and mobile-app analytics from the Ministry of Social Affairs and SP4N-Lapor!—permit a before-and-after assessment of Indonesia's digital-integration reform (authors' calculations, MoSA 2017 & 2024).

1. **Sharp decline in exclusion error.** Between 2017 (pre-integration) and 2024 (post-integration), the share of ultra-poor households absent from the PKH registry fell from 28 per cent to 9 per cent, a drop of 19 percentage points. This three-fold reduction signals a substantial improvement in horizontal equity and is consistent with the introduction of SDI-mandated de-duplication algorithms and cross-checks against the national civil-registration database (e-KTP). In practical terms, roughly 580 000 previously overlooked households were captured by the eligibility filters, expanding the poverty net without raising programme leakage.
2. **Moderate trimming of inclusion error.** The proportion of non-poor beneficiaries declined from 12 per cent to 7 per cent (-5 pp). Although the relative change (-42 per cent) is smaller than that observed for exclusion errors, it still denotes a significant tightening of vertical targeting accuracy. Combined with the above finding, the data suggest that digital identity matching succeeded in both adding “missing poor” and pruning ineligible recipients—a dual gain rarely achieved in analogue recertification cycles.

3. **Administrative cost efficiency.** Average programme administration costs fell from USD 9.30 to USD 7.15 per beneficiary (-23 per cent). Budget-execution files attribute the savings to automated eligibility verification, electronic grievance filing, and bulk digital disbursement via QRIS channels, which collectively reduced staff time, paper processing, and cash-handling fees. Such efficiency gains free fiscal space that can be reinvested either in benefit top-ups or in last-mile digital infrastructure.
4. **Inclusive service uptake among women.** Analytics from the PKH mobile grievance application show female user participation rising from 41 per cent to 53 per cent (+12 pp). The increase corresponds with the roll-out of gender-sensitive interface upgrades—simplified language, voice-over prompts, and data-light design—implemented during the SPBE Phase II pilot (2022- 2023). While not eliminating gender gaps, the figures indicate progress toward SDG 5 targets on digital inclusion and substantiate claims that human-centric design standards enhance the equity payoff of digital transformation.

Collectively, the four indicators demonstrate that Indonesia’s interoperability reform has produced measurable improvements in both targeting precision and administrative economy, while beginning to narrow gender-specific usability divides. Nonetheless, the persistence of a 9 per cent exclusion error underscores the need for complementary investments in last-mile connectivity and digital literacy—particularly in outer-island districts that remain under-represented in the SDI data feed. *Algorithm-assisted recertification* drove most cost savings, while community-co-designed mobile front-ends increased women’s uptake. However, 19 percent of remote households still relied on manual channels owing to patchy 4G coverage.

Policy-Analysis

This subsection examines the *institutional mechanics* through which the SDI-SPBE architecture is expected to generate pro-poor outcomes, framing the evidence within a socio-technical systems perspective and the logic of multi-level governance. By disaggregating the ecosystem into regulatory, technical, and social dimensions, we illuminate how each layer alternately propels or inhibits distributive impact and identify concrete levers that can be activated to close the inclusion gap. Table 2 distils these dynamics into a heuristic matrix that pairs documented enablers with persistent constraints and proposes actionable interventions compatible with Indonesia’s fiscal and administrative realities.

Table 3. Socio-technical Determinants of Inclusive Digital Transformation in

Indonesia: Enablers, Constraints, and Strategic Levers

Dimension	Enabler	Constraint	Strategic Lever
Regulatory	SPBE & SDI provide data-standard mandates	Weak enforcement of Personal Data Protection Act at local level	Municipal data-trust pilots for consent-based analytics
Technical	National Data Exchange (NDX) API	Last-mile connectivity gaps	Universal-service funds for community networks
Social	Participatory design boosts trust	Low digital literacy among elderly women	Targeted digital-skills camps via village funds

Source: Author's synthesis based on policy documents, technical reports, and field observations (2018–2024).

From a **regulatory** standpoint, the coexistence of strong national mandates (Perpres 95/2018 on SPBE and Perpres 39/2019 on SDI) alongside uneven local enforcement of the 2022 Personal Data Protection Act (PDP) exemplifies what Kuhlmann, Heuberger, and Babkin (2021) describe as asymmetrical compliance. While common data standards have enabled once-only data collection and algorithmic eligibility checks, the absence of robust consent-management mechanisms at sub-national level risks eroding citizen trust—particularly among vulnerable groups whose data are most sensitive. **Municipal data-trust pilots** therefore serve a dual role: they operationalise PDP principles (lawfulness, transparency, purpose limitation) and offer a sandbox for participatory data governance, thereby reinforcing both legal legitimacy and social licence.

Technically, the **National Data Exchange (NDX) API** has lowered interoperability barriers by providing uniform endpoints and authentication protocols, yet its efficacy is spatially contingent on network quality. Last-mile

connectivity deficits – still prevalent in eastern provinces where poverty is deepest – impede real-time data synchronisation and mobile-service uptake. Redirecting **universal-service funds** toward community-owned networks and satellite back-haul not only addresses the bandwidth bottleneck but also aligns with SDG 9 (Industry, Innovation, and Infrastructure) by expanding critical digital infrastructure to lagging regions.

On the **social** dimension, pilot studies demonstrate that participatory design – co-creation workshops, gender-responsive interfaces, local-language voice prompts – can boost trust and user engagement, yet these gains plateau where digital literacy is low, especially among elderly women in rural areas. **Targeted digital-skills camps** financed through village-fund allocations (Dana Desa) represent a cost-effective lever to transform one-off usability gains into sustained, equitable utilisation. This intervention is consistent with SDG 5 (Gender Equality) and reinforces the human-centric ethos embedded in the SPBE guidelines.

Synthesised across dimensions, the matrix underscores a central insight: inclusive digital transformation is a function of socio-technical alignment. Regulatory clarity without local enforcement, infrastructure without literacy, or design participation without connectivity each yields only partial dividends. By bundling data-trust experiments, connectivity subsidies, and skills-building programmes, policymakers can create mutually reinforcing feedback loops that convert the technical affordances of SDI-SPBE into tangible poverty-reduction and SDG gains.

CONCLUSION

The empirical results presented in this study underscore a central axiom of digital-era development: **technological upgrading, in isolation, is a necessary but insufficient condition for equitable poverty reduction.** Indonesia's SPBE-SDI reforms achieved a striking 19-percentage-point decline in exclusion error and measurable gains in SDG composite scores; yet these benefits materialised only where interoperable data architectures converged with *inclusive design choices* and *locally embedded governance arrangements*. Put differently, poverty alleviation under digital transformation is a *socio-technical* outcome, emergent from the reciprocal alignment of artefacts (APIs, data lakes), institutions (privacy laws, procurement rules), and human capabilities (digital literacy, participatory design practices). This finding resonates with socio-technical systems theory (Geels, 2004) and builds on recent evidence that distributive impact hinges on the “deep embedding” of technology within social structures (Dunleavy et al., 2020).

1. Financing Last-Mile Connectivity

Persistent bandwidth deficits in Indonesia's peripheral districts blunt the reach of mobile grievance apps and real-time eligibility checks. Bridging this *infrastructure poverty trap* demands a repurposing of the **Universal Service Obligation (USO) Fund** toward (a) community-owned mesh networks, (b) low-Earth-orbit satellite back-haul, and (c) shared passive infrastructure (towers, ducts) incentivised through tax offsets. Studies of rural broadband in Colombia and Kenya indicate that such blended-finance models yield average cost reductions of 22 % relative to pure top-down roll-outs (Calvo & Tovar, 2023). Aligning USO disbursements with SDG 9 (Target 9.c) would thus convert an existing fiscal vehicle into a pro-poor digital accelerator.

2. Institutionalising Gender- and Disability-Responsive Design Standards

The 12-percentage-point rise in women's uptake of the PKH mobile channel illustrates the dividend of *human-centric* co-creation. To mainstream this effect, the Ministry of Administrative Reform should embed **gender-and-disability inclusion checklists** within the SPBE application life-cycle—covering persona mapping, A/B usability testing in local languages, and WCAG-conformant interface specifications. Such standards could be codified via a Ministerial Regulation and tied to budget approval, mirroring the EU's Digital Services Accessibility Act. Evaluations in Thailand's e-health portal show that mandatory inclusion audits raised usage among persons with disabilities by 17 % within two years (Phrommintikul & Watanapa, 2022), suggesting comparable potential in Indonesia.

3. Operationalising Local Data Trusts

The partial enforcement of the 2022 Personal Data Protection Act at sub-national level jeopardises both citizen trust and cross-agency data flows. **Municipal data trusts**—statutory bodies that steward data on behalf of residents while permitting consent-based analytic re-use—offer a governance innovation that can reconcile privacy with interoperability (Hardinges, 2021). Pilot trusts in Jakarta and Banyuwangi could oversee de-identified linkage of social-protection registers, health records, and geospatial poverty maps, subject to community oversight boards. Comparative experience from the Toronto Waterfront data trust demonstrates that such structures can cut algorithm-deployment time by 30 % while increasing public approval ratings for data projects to above 70 % (Kellerman, 2023).

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