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# Public-Sector Innovation To Narrow The Urban–Rural Digital Divide For Inclusive Smart Tourism In Indonesia: A Systematic Review

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**Abstract**

This systematic review synthesizes evidence on government-led digital innovations advancing inclusive smart tourism in Indonesia and narrowing the urban–rural digital divide. We examine smart-tourism apps, QR-based cashless payments, destination management systems, chatbots, and AR/VR, alongside public programs for broadband expansion, youth skills, and smart villages. Findings indicate these measures improve access for Gen Z/Millennial travelers and rural SMEs, enable data-driven management, and broaden market reach. Persistent gaps in connectivity, digital literacy, and local capacity limit impact. We outline implications for digital inclusion, regional equity, and youth-focused growth and propose priorities for sustainable policy design.

**Keywords:** Digital innovation, Digital divide, Smart tourism, Destination Management Systems (DMS), Mobile Positioning Data (MPD).

## INTRODUCTION

Tourism in Indonesia is undergoing rapid digital transformation, driven by market shifts toward mobile-first travel and by an expanding suite of public-sector innovations. National strategies since 2020 have explicitly repositioned "Tourism 4.0" as a pillar of recovery and competitiveness, prioritizing digital marketing, platform integration for Micro, Small and Medium Enterprises (MSMEs), cashless payments, and skills development (Kemenparekraf / Baparekraf, 2022; Susilo, 2020). Policy activity intensified during and after the pandemic, in which the analyses of 1879–2022 regulatory texts show a marked surge in tourism–digital linkages in 2020–2022, signaling sustained state commitment to technology-enabled destination management (Nanda, Widianingsih, & Miftah, 2023). The main factor of this transformation is a state-led "digital rails" agenda. The Palapa Ring backbone expanded

connectivity across 514 regencies/cities and the SATRIA-1 high-throughput satellite now targets last-mile access in frontier and rural regions, preconditions for smart services in dispersed archipelagic destinations (Medina, 2020; Thales Alenia Space, 2023). At the same time, the government has mandated integrated digital public services through e-government via "Sistem Pemerintahan Berbasis Elektronik" (SPBE) and launched GovTech "INA Digital," while "Satu Data Indonesia" establishes common standards for interoperable, reusable public data (Kementerian Sekretariat Negara Republik Indonesia, 2018, 2022; Office of Assistant to Deputy Cabinet Secretary for State Documents & Translation, 2019; Sekretariat Kabinet Republik Indonesia, 2024). These rails are complemented by transaction infrastructure such as QRIS (Indonesia's national QR payment standard), which underpins cashless visitor journeys and MSME onboarding (ANTARA, 2023; Bank Indonesia, 2022).

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Demand-side dynamics reinforce the urgency of inclusive digitalization. Millennials and GenZ dominate Indonesia's population and exhibit smartphone-centric, social-media-driven travel behaviors, with decisions heavily shaped by digital information and continuous connectivity (Demolingo et al., 2021; Indonesian Ministry of Tourism and Creative Economy, 2022; Nurhandini, Triastuti, & Istanto, 2023). Yet readiness remains uneven, in which city-level assessments for Jakarta highlight gaps in data integration, infrastructure, and end-to-end service digitization that limit seamless experiences (Akbar, Auliya, Pranita, & Oktadiana, 2024). In rural and community-based tourism, many villages now appear on Online Travel Agencies (OTAs) and social platforms, but inconsistencies between official content and marketplace listings persist, reflecting coordination and interoperability challenges that can reduce commercialization (Priatmoko & David, 2021). A growing body of Indonesian scholarship and policy practice points beyond promotion toward data-driven destination management. PostCOVID-19 lessons at flagship sites such as Borobudur call for integrated digital systems to manage flows, capacity, and visitor experience (Heslinga, Yusuf, Damanik, & Stokman, 2024). Indonesia's statistics system has shifted core measurement into the digital domain, through mobile positioning data (MPD) and new digital tourism surveys, while contemporaneous work details the governance, privacy, and quality arrangements required for lawful scale-up (BPS, 2025; Lestari, Esko, Sarpono, Saluveer, & Rufiadi, 2018; Rahmadian, Virantina, Feitosa, Zwitter, & Lestari, 2023). These capabilities enable local DMO dashboards and protected-area booking that move apps from brochureware to operational gateways (Kusumawati, Yasmin, Lasmy, Gunawan, & Renanda, 2023; Syahrul, Ritonga, Zulfan, & Hasriyani, 2024).

Across specific technologies, evidence is accumulating but fragmented. Cashless payments via QRIS show positive effects on user satisfaction and transaction efficiency, with adoption wellexplained by perceived ease/usefulness and trust, and with suggestive links to MSME revenue growth (Gunawan, Fatikasari, & Putri, 2023; Hamzah Muchtar et al., 2024; Purnamasari, 2023). Border facilitation reforms such as Electronic Visa on Arrival (e-VOA) extend the digital journey across arrival processes (Ichsan, Sugandi, Sumadinata, & Ismanto, 2024). Conversational agents, ranging from low-cost Telegram bots to AI chatbots, improve information access and engagement and can even promote pro-environmental behavior, though inclusivity and operator capacity remain constraints (Anak Agung Gede Wijaya, 2025; Fibriasari, Waluyo, Baharuddin, Putri, & Rahmadany, 2024; Majid, Tussyadiah, Kim, & Chen, 2024; Orden-Mejía, Carvache-Franco, Huertas, Carvache-Franco, & Carvache-Franco, 2023). Immersive media are similarly important. Augmented Reality/Virtual Reality (AR/VR) supports heritage communication, global reach, and potentially lower-impact, more accessible experiences. These attributes matched to Indonesia's dispersed, often fragile tourism assets (Aldo Arista, Daniel Hendra, Felix Juwono, Kanz Abdillah, & Permana, 2023; Hidayat, Indra, Yunita, Marsha, & Hapsari, 2023; Sharma, Lim, & Aggarwal, 2024).

Despite momentum, an urban–rural digital divide persists. Connectivity has expanded but affordability, device constraints, and reliability still hinder adoption in 3T (Terdepan, Terluar, dan Tertinggal/Frontier, Outermost, and Underdeveloped) areas; institutional capacity for data stewardship and platform upkeep varies widely; and write-back mechanisms between public portals and commercial platforms are weak (Medina, 2020; Muhtar, Abdillah, Widianingsih, & Adikancana, 2023; Priatmoko & David, 2021). National initiatives, from Smart City masterplans to Tourism Village competitions (ADWI/BETI-DEWI) and digital-talent programs seek to close these gaps by combining infrastructure with skills and incentives (ANTARA, 2024; Direktorat Jenderal Aplikasi Informatika,

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2021; Kemenparekraf/Baparekraf RI, 2021, 2024; Komdigi, 2025). Yet questions remain about sequencing, interoperability, and the causal impacts of digitization on inclusion and sustainability outcomes. This review responds to these gaps by systematically synthesizing evidence on public-sector digital innovations relevant to inclusive smart tourism in Indonesia. We integrate peer-reviewed studies and official policy sources across five innovation streams: smart apps/platforms, cashless payments, destination management systems, chatbots/virtual assistants, and AR/VR, situating them within broader state capability reforms. By consolidating diverse literatures and policies, we aim to inform a next generation of bundled, interoperable, and people-centred digital strategies capable of narrowing Indonesia's urban–rural divide while advancing inclusive, sustainable smart tourism.

## METHODS

We conducted a systematic review of public-sector digital innovations that aim to narrow Indonesia's urban–rural digital divide in smart tourism. A PRISMA flow diagram is provided in Figure 1. Search strings combined concept clusters: (smart/digital tourism) AND (public sector/policy) AND (Indonesia) AND (divide/inclusion) AND (technologies).

### 2.1. Eligibility Criteria

We combined a PICOS style frame tailored to public administration and tourism, as seen in Table 1.

**Table 1.** Eligibility criteria and operational rules

| Dimension | Include if... | Exclude if... |
|---|---|---|
| Context | Indonesia tourism or policies/programs affecting tourism. | Outside Indonesia with no Indonesiaspecific analysis. |
| Intervention | Public-sector digital innovation (apps, QRIS, DMS/MPD, chatbots, AR/VR, smart-village, youth skills). | Private marketing only; no government role. |
| Methods | Empirical or analytic conceptual/policy evaluation. | Descriptive opinion with no method. |
| Outcomes | Any inclusion, performance, or Outcomes unrelated to governance metric. inclusion/tourism. | |

### 2.2. Information sources

- Bibliographic databases: Scopus and Web of Science (WoS) were used as primary databases because of their robustness for systematic discovery in social sciences; Google Scholar was used for supplementary.
- Publisher portals for full-text: Wiley Online Library, Taylor & Francis, SpringerLink.
- Grey literature / policy: Official sites of Kemenparekraf, Kominfo, BPS, Bank Indonesia, Setkab, Kemenkumham for regulations, programs, and technical notes (e.g., SPBE, Satu Data, QRIS, SATRIA-1, e-VOA).

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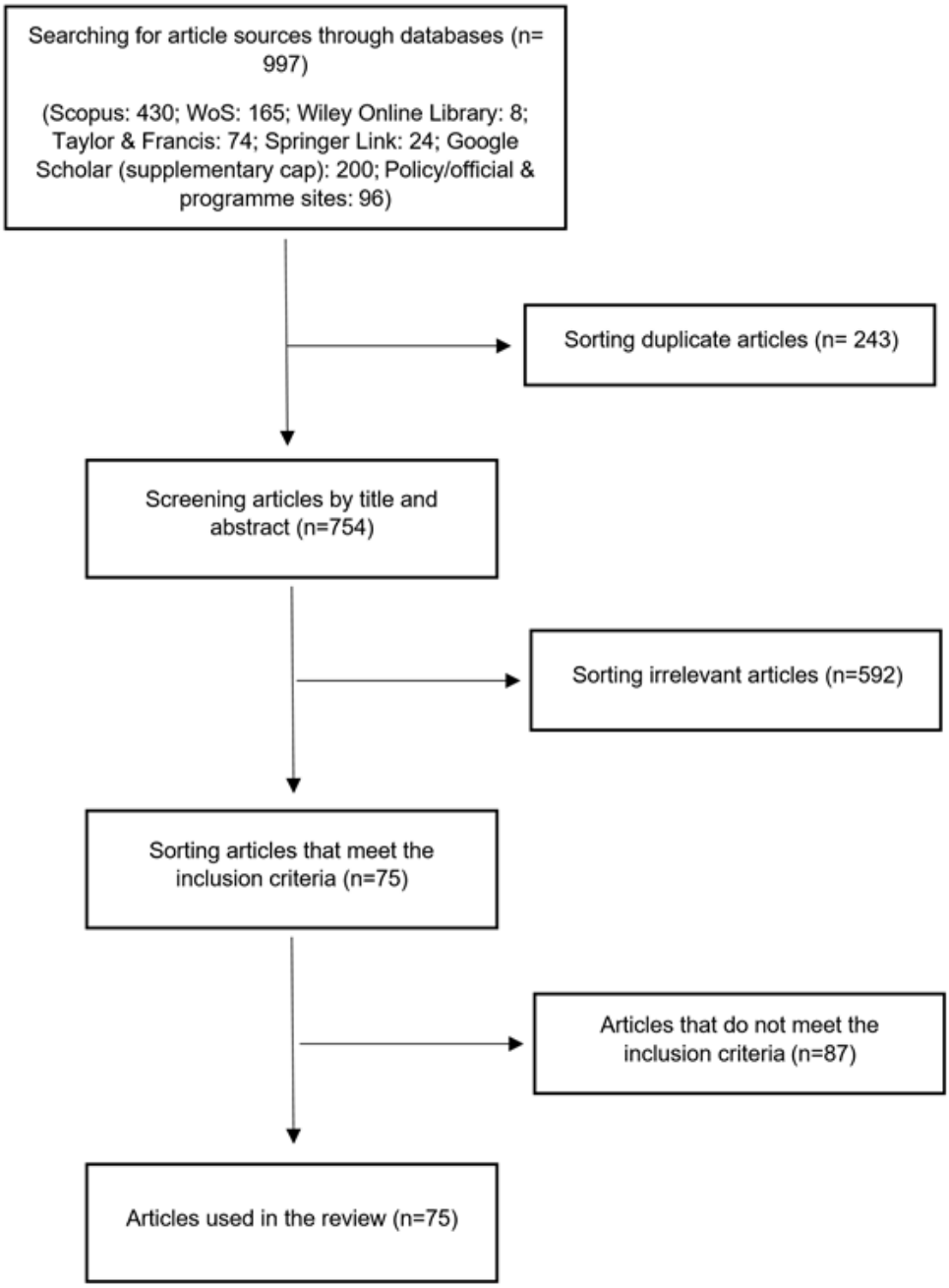


**Figure 1.** PRISMA flow diagram

## RESULTS AND DISCUSSION

### 3.1. Public Sector Capability Stack for Inclusive Smart Tourism

Table 2 summarizes selected peer-reviewed studies relevant to public sector innovation in Indonesia's digital tourism. These studies illustrate empirical evidence and scholarly insights on various innovation themes, from smart tourism and marketing to rural digital transformation and service innovation.

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**Table 2.** Studies on Indonesian digital tourism innovation

| References | Methodology | Key Findings | Relevance to Digital Tourism in Indonesia |
|---|---|---|---|
| (Susilo, 2020) | Qualitative content analysis of government strategies and documents. | Indonesia drives post-COVID19 tourism recovery by partnering with SOEs, start-ups, and local communities to prioritize four pillars of digital tourism: distribution channels, promotion, payments, and training. | Defines Indonesia's public sector–led digital tourism strategy, detailing infrastructure and incentives (ITX for distribution, QRIS for payments, capacity building). |
| (Priatmoko & David, 2021) | Mixed methods: analysis of Online Travel Agency listings and case comparisons of tourist villages. | Many Indonesian rural tourism villages now use OTAs and social media, but mismatches with official village data reveal integration gaps, showing the need for tighter collaboration between village operators and app developers to improve outcomes. | Digital adoption in Indonesia's rural tourism is expanding through public–private collaboration; with government guidance villages can access online markets, but sustained support is needed to realize the potential and navigate community-based digitalization challenges. |
| (Bachri & Lonik, 2023) | Literature review and analysis of best practices in public service delivery. | Technology-driven tools (from digital information platforms and navigation apps to online visa systems) have increased tourist convenience and efficiency in Indonesia, showing the need for public–private collaboration and sustainable implementation. | Digital public services (such as e-visas and official apps) are important to Indonesia's tourism growth and visitor satisfaction, confirming that government-led tech innovation and partnerships align with global trends and are essential to attract and retain tourists. |
| (Nanda et al., 2023) | Policy content analysis of 87 tourism and digital transformation policies; quantitative & qualitative analysis. | Tourism policy increasingly embeds digital transformation (peaking in 2020–2022), signaling a strong tourism–tech linkage and foreshadowing more supportive, tech-oriented management policies ahead. | Indonesia has solidified a strong policy commitment to digital tourism, with COVID19 accelerating pro-innovation support and reproducing regulations (e-services, hygiene/ CHSE-aligned digital standards) to drive adoption. |
| (Demolingo et al., 2021) | Empirical study with surveys (n=100 millennial tourists, domestic & international) and interviews. | Millennial tourists in Gili Trawangan (domestic and foreign) are smartphone-centric, heavily swayed by social media and digital ads, and share a main expectation of seamless digital connectivity, with only minor behavioral differences between the groups. | public-sector investment in social media campaigns and main digital amenities like WiFi and online information. |
| (Hidayat et al., 2023) | Systematic literature review of 98 academic articles on AR/VR in creative sectors. | Indonesia positions AR/VR as widely used, strategic tools for immersive marketing and global reach, sustaining tourism and creative industries, projecting its digital economy vision, and sharpening competitive appeal. | Immersive tech (AR/VR) is a key factor in Indonesia's tourism innovation, with virtual tours and AR cultural apps promoted to enrich experiences and backed by strong publicsector support under Tourism 4.0. |

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| References | Methodology | Key Findings | Relevance to Digital Tourism in Indonesia |
|---|---|---|---|
| (Anak Agung Gede Wijaya, 2025) | Case study analysis of chatbot deployments in Bali's tourism sector. | Chatbots in Bali increase satisfaction and loyalty through real-time, personalized help, but their effectiveness depends on SME digital readiness, culturally/linguistically adapted design, and supportive, trustoriented policies. | AI chatbots are rising in Indonesia's tourism, but scaling them requires public– private solutions for infrastructure and cultural fit, spotlighting where government should guide and standardize smart-tourism assistants. |
| (Akbar et al., 2024) | Multi-criteria readiness assessment; secondary data & indicators for Jakarta | Finds uneven smart-tourism readiness across Jakarta's districts; gaps in data integration, infrastructure, and service digitization hinder visitor experience; prioritizes governance and platform interoperability. | Direct guidance for publicsector planning of smart tourism (city apps, mobility info, open data), highlighting where to invest to raise service quality and inclusivity. |
| (Ariyani & Fauzi, 2023) | Prospective MULTIPOL analysis with FGD/ workshops in Central Java's Kedung Ombo area | Identifies ICT strengthening among top policy programs for rural tourism transformation, alongside governance and amenities. | Shows policy-level prioritization of digital infrastructure/literacy for tourism villages; key to narrowing urban–rural gaps. |
| (Khalika, Aini, & Azizurrohman, 2025) | PLS-SEM survey (n=380) across 6 destinations (Jakarta, Bandung, Yogyakarta, Malang, Bali, Lombok) | Smart destination management (infrastructure, comms, crowd management) to increase tourist satisfaction; digital literacy moderates tech effectiveness; crowd management effects stronger in island destinations. | Evidence for inclusive smartservice rollouts and literacy programs; supports targeting youth travelers with usable, accessible tools. |
| (Rafdinal, 2021) | TAM-based PLSSEM (n=324), West Java tourists | Smart tourism technology → perceived usefulness/ease → attitude → visit intention → increase visits; underscores role of government and providers in enabling tech. | Empirical pathway linking smart tech to visitation; supports public–private deployment of digital services (apps, Wi-Fi, wayfinding). |
| (Ferdian et al., 2024) | Survey/SEM on tourism villages in West Sumatra | Stakeholder commitment (include local government) predicts sustainable village performance; digital components are part of capability building. | Underlines governance and capacity (including digital) for smart village tourism; relevant to rural youth engagement. |
| (Kusumastuti, Pranita, Viendyasari, Rasul, & Sarjana, 2024) | Qualitative case study (Kenderan post-smart tourism village, Bali) | Shows how local value and digital storytelling/ governance sustain tourism villages beyond initial "smart" pilots. | Practical lessons for scaling & sustaining digital village initiatives across Indonesia's diverse regions. |
| (Ramadhan, 2024) | AR concept & interviews with Gen-Z (Yogyakarta) | Instagram-based AR filters effectively convey heritage info, navigation and responsibletourism cues; calls for government–creator collaboration. | Youth-centric, low-cost immersive outreach model that public agencies can deploy at urban & rural sites. |

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| References | Methodology | Key Findings | Relevance to Digital Tourism in Indonesia |
|---|---|---|---|
| (Agustan, Rianse, Sukotjo, & Faslih, 2024) | TOPSIS + 6As framework: Wakatobi smartdestination assessment | Proposes multi-criteria roadmap to implement smart-destination elements (accessibility, amenities, ancillary digital services). | Offers decision tool for districts/ islands to prioritize digital service layers alongside hard infrastructure. |
| (Muhtar et al., 2023) | Bibliometric study (Cogent Social Sciences) on smart villages in Indonesia | Maps smart-village trends; highlights ICT, digital literacy, and governance as central to rural empowerment. | Positions smart village policy as a public-sector innovation pathway to bridge the urban–rural digital divide in tourism regions. |
| (Subawa, Widhiasthini, Permatasari, & Sri Wisudawati, 2022) | Bali MSME- focused journal article | Argues digitally capable tourism MSMEs are important to Bali's recovery; stresses innovation, online presence, and policy support. | Connects public policy and MSME digitization (ecommerce, social media, cashless) to destination resilience and youth employment. |

Across the five innovation streams reviewed: smart apps/platforms, cashless payments, destination management systems (DMS), chatbots/virtual assistants, and AR/VR, the Indonesian case consistently shows that digital inclusion in tourism is unlocked when three state-steerable capability layers move together:

1. Digital rails (infrastructure, standards, and data plumbing): Palapa Ring and SATRIA1 for reach; QRIS for interoperable retail payments; SPBE & Satu Data for service integration and data interoperability (Bank Indonesia, 2022; Kementerian Sekretariat Negara Republik Indonesia, 2018, 2022; Medina, 2020; Thales Alenia Space, 2023).
2. Public service layers (platforms and operational systems): ITX marketplace, e-VOA, DMS dashboards, protected-area booking, city/village apps (Heslinga et al., 2024;

   Kementerian Imigrasi dan Pemasyarakatan, 2022; Kusumawati et al., 2023; Susilo, 2020).
3. Activation & capacity (people, incentives, governance): youth skills (DTS; "4 AS"), ADWI/BETI-DEWI competitions, DMO coordination, MPD governance (ANTARA, 2024; Indonesian Ministry of Tourism and Creative Economy, 2022, 2023; Muhtar et al., 2023; Rahmadian et al., 2023).

When any one-layer lags, the urban–rural divide reopens even after visible pilots: e.g., good rails without MSME onboarding (rural areas), apps without interoperable payments or accurate village listings, or dashboards without data-sharing mandates. The thematic results align with this "stack" logic: adoption is highest where rails + services + activation are bundled, and weakest where they are sequenced or siloed. Table 3 shows the state of the digital rails and how they enable the service layer.

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**Table 3.** Digital transformation policies (enablers of digital tourism)

| Policy / Program | Years | Lead agency | What it does (for tourism) | Status / notes | Sources |
|---|---|---|---|---|---|
| Indonesia Digital Roadmap | 2021-2024 | Ministry of Communications and Informatics | National playbook across 4 pillars: digital infrastructure, government, economy, and citizens are used to accelerate digitalization (skills, platforms, infrastructure) that destinations and tourism MSMEs rely on. | Completed cycle end2024; framework underpins ongoing initiatives. | (Ministry of Communication and Digital Affairs, 2021, 2022; Wihardja, Pradana, Wibisana, & Swarnata, 2024) |
| SPBE (Electronic-Based Government System) & National SPBE Architecture | 2018– present (architecture issued 2022) | Ministry of Administrative and Bureaucratic Reform / Ministry of Communications and Informatics (GovTech INA Digital) | Mandates integrated digital public services; in 2024 INA Digital (GovTech) launched to unify government apps (relevant for permits, visitor services, data sharing). | Perpres 95/2018 & Perpres 132/2022 in force; INA Digital launched May 27, 2024. | (Kementerian Sekretariat Negara Republik Indonesia, 2018, 2022; Sekretariat Kabinet Republik Indonesia, 2024) |
| Satu Data Indonesia (One Data) | 2019 – present | Ministry of National Development Planning & One Data Indonesia (SDI) Secretariat | Sets national data standards/ metadata to make government data interoperable, useful for tourism stats, event calendars, mobility data. | National policy since 2019; local action plans piloted in several regions. | (Ministry of National Development Planning, 2020; Office of Assistant to Deputy Cabinet Secretary for State Documents & Translation, 2019). |
| SATRIA-1 highthroughput satellite | 2023 – present | Ministry of Communications and Informatics /BAKTI | Extends broadband to 3T (frontier/ outermost/least-developed) areas, critical for rural/rim destinations and digital ticketing/ QR payments. | Launched June 19, 2023; service rollout targeted to tens of thousands of public sites. | (Indonesian Ministry of Communication s and Informatics, 2023; Thales Alenia Space, 2023) |

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| Policy / Program | Years | Lead agency | What it does (for tourism) | Status / notes | Sources |
|---|---|---|---|---|---|
| QRIS (national QR payment standard) | 2019 – present | Bank Indonesia | Interoperable QR payments for MSMEs and attractions, reduces cash handling, supports youth travelers' cashless habits. | National standard; expanded via "QRIS Tuntas" and rapid user/ merchant growth. | (ANTARA, 2023; Bank Indonesia, 2022) |
| Digital Talent Scholarship (DTS) | 2018 – present | Ministry of Communications and Informatics (BPSDMP) | Mass digital-skills training (leadership, entrepreneurship, gov transformation, content, etc.) used by local govts/ DMOs and youth tourism workers. | ~100k participant target in 2024; multiacademy program ongoing. | (ANTARA, 2024; Komdigi, 2025) |
| OSS-RBA online business licensing | 2021 – present | Ministry of Investment/ BKP M | Fully online, risk-based permits, speeds set-up of accommodation, tours, F&B, events; reduces face-to-face steps for rural MSMEs. | Implemented under GR 5/2021; live since July/Aug 2021. | (Ministry of Investment, 2022; UNCTAD, 2021) |

## 3.2. Thematic Findings by Innovation Type

### 3.2.1. Smart tourism apps and platforms

Adoption of smart tourism apps in Indonesia is rising but uneven. Readiness studies indicate that Jakarta has strong potential, yet persistent gaps in data integration, infrastructure, and endto-end service digitization still limit truly seamless city-to-visitor applications (Akbar et al., 2024). At the regional level, DMO-built tools such as Visiting Jogja, along with platform integrations (e.g., Tiket. com) and pandemic-era utilities like PeduliLindungi, have improved information access, mobility, and booking. However, researchers repeatedly flag inconsistencies between official village content and OTA listings that can confuse users and dampen conversion (Aw, Agustinova, Fitriana, Arif, & Wulansari, 2024; Pramusita, Priyambodo, Mustofa, & Arymami, 2023). Nationally, the government-backed Indonesia

Tourism Exchange (ITX) exists but studies argue its value grows only when tightly linked to MSMEs, local apps, and interoperable payment rails so that smaller suppliers become reliably bookable online (Said, Amirullah, Raihansyah, & Kurniawan, 2024; Satrya, Kaihatu, & Budidharmanto, 2023). Protected-area pilots (such as Bromo Tengger Semeru National Park's post-pandemic prototypes) show mobile booking and on-site management features can turn destination apps into operational

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gateways rather than mere brochures (Kusumawati et al., 2023). Consistent with these platform trends, empirical work in Yogyakarta and other sites finds that apps and social media together shape Gen-Z and Millennial planning and on-site behavior, reinforcing why public platforms must be accurate, timely, and youth-oriented (Nurhandini et al., 2023).

### 3.2.2. Digital payments and cashless tourism

QRIS has effectively become Indonesia's de facto retail payment rail for travel and tourism, with adoption patterns well explained by perceived ease and usefulness, trust, and social influence in Unified Theory of Acceptance and Use of Technology/ Technology Acceptance Model (UTAUT/TAM), which in turn lift willingness to use (Hamzah Muchtar et al., 2024). Multi-city evidence shows tourism-adjacent transactions (transport, food and beverage, attraction tickets) benefit from QRIS through higher transaction efficiency, improved user satisfaction, and growing trust in cashless options that align with visitor expectations (Gunawan et al., 2023). On the supply side, Indonesian SEM studies connect merchant adoption of QRIS with revenue or income growth among MSMEs, a critical effect for destination supply chains that depend on small providers (Purnamasari, 2023). Research on Bank Indonesia's communication strategy further suggests that targeted outreach and financial-literacy efforts accelerate adoption, an especially important factor for rural and village-based merchants entering formal digital ecosystems (Pratiwi, 2025). At the border, digitized entry systems such as e-VOA complement cashless travel by smoothing arrivals and supporting Bali's recovery narrative, completing the cashless journey from pre-arrival to on-site spend (Ichsan et al., 2024).

### 3.2.3. Digital Destination Management Systems (DMS)

Post-COVID lessons at Borobudur and other flagship sites argue that destinations must shift from promotion-heavy approaches to data-driven management, optimizing flows, capacity, and experience design via integrated digital systems (Heslinga et al., 2024). Indonesia's statistics agency (BPS) has moved main measurement into the digital domain through Mobile Positioning Data (MPD) and a Domestic Tourism Digital Survey, providing timely inputs that DMS dashboards can operationalize for planning and monitoring (BPS, 2025). Case work on MPD governance highlights inter-agency roles, data quality, and regulatory compliance as prerequisite issues that DMS programs must solve to be credible and scalable (Rahmadian et al., 2023). Long-running MPD pilots by BPS/Ministry of Tourism have already measured cross-border arrivals since the late 2010s, offering methodological groundwork for broader DMS use across regions and products (Lestari et al., 2018). At local level, DMO evaluations (such as Samosir Regency) show that institutional coordination and information systems capacity largely determine program effectiveness, aligning directly with the organizational demands of DMS adoption (Syahrul et al., 2024). Related implementation studies on tourismvillage digital management models and protected-area booking apps confirm that DMS features are moving into day-to-day destination operations rather than remaining as standalone marketing tools (Hastuti, Sopingi, Hendra Prabowo, & Waka Aji, 2022; Kusumawati et al., 2023). Table 4 shows how national strategies (ITX, MPD, youth programs) can be operationalized inside DMS rollouts.

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**Table 4**. National Strategies and Initiatives

| Institution & Initiative | References | Program Description & Digital Focus | Implementation Status (2025) |
|---|---|---|---|
| Ministry of Tourism & Creative Economy (MoTCE): Strategic Plan 2020– 2024: "Tourism 4.0" Agenda | (Susilo, 2020) | Incorporated digital transformation as a main strategy in the national tourism plan. Focus on digital marketing (promotion via online channels), digital distribution platforms (emarketplaces for tourism SMEs), cashless payments at attractions, and digital skills training for tourism workers. Aimed to implement technology for tourism recovery and competitiveness post-COVID- 19. | In progress: Digital elements embedded in campaigns (70% of tourism promotion now online), partnerships formed (e.g., with Telkom for ITX). Accelerated by pandemic eticketing, virtual events, and hygiene apps implemented. Ongoing through 2024 with monitoring by MoTCE and targets in RPJMN. |
| Ministry of Tourism & CE: "4 AS" Youth Innovation and Upskilling Program | (Indonesian Ministry of Tourism and Creative Economy, 2022) | National initiative focused on Gen Z and Millennials (54% of population) to drive tourism recovery. "4 AS" principles: Kerja KerAS (Work Hard), Kerja CerdAS (Work Smart with digitalization & virtualization), Kerja TuntAS (Work Thorough), Kerja IkhlAS (Work Sincerely). Delivers technical training, webinars, mentorships, and incubators to equip youth with digital and creative skills in tourism. Uses big data to map youth opportunities. | Ongoing: Rolled out across major cities (Jakarta, Bandung, etc.) in 2022–2023 with thousands of youths trained in digital marketing, content creation, and e-commerce for tourism. By 2025, continues to expand with collaborations (universities, start-ups). Seen as key to post-pandemic job creation in tourism, with early outcomes in new youth-led travel businesses and digital content campaigns. |
| Ministry of Tourism & CE: Anugerah Desa Wisata Indonesia (ADWI) – Digital Tourism Village Award | (Indonesian Ministry of Tourism and Creative Economy, 2023) | Annual national award program to incentivize and accelerate digital transformation in tourism villages. One of five judging categories is "Digital and Creative", evaluating villages on digital presence, content creation, and use of technology in promotion and services. Provides recognition and support to top villages (e.g., equipment, training for people who excel in digital category). | Established & expanding: Held in 2021, 2022, 2023, and 2024 with hundreds of villages participating each year. Many villages improved social media usage, online booking availability, and virtual tour content to compete. Winning example: Gunungsari Village (East Java) won 1st Place Digital Village 2024 for its smart village app and AR cultural tour. Program continues to 2025+, integrated into MoTCE's rural tourism development strategy. |

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| Institution & Initiative | References | Program Description & Digital Focus | Implementation Status (2025) |
|---|---|---|---|
| Ministry of Communication & Informatics: Palapa Ring National Fiber Optic Backbone | (Medina, 2020) | A "highway in the sky" infrastructure project connecting all 514 regencies/cities via ~36,000 km of fiber-optic cable. Provides 4G broadband internet access across the archipelago, enabling digital services (etourism, e-learning, e-health) nationwide. | Completed (Operational): As of late 2019, all backbone rings (West, Central, East) finished. By 2020–2021, over 500 districts attained 4G connectivity through this backbone, supported by installation of 4,000+ new cellular towers in remote areas. This improved internet availability in emerging tourist destinations (e.g., Mandalika, Labuan Bajo). Ongoing efforts to upgrade capacity (100 Gbps links to outlying regions) and extend last-mile connectivity (village Wi-Fi) are in progress under Kominfo. |
| MoTCE & Telkom (SOE): Indonesia Tourism Exchange (ITX) Platform | (Susilo, 2020) | A digital marketplace platform for tourism services, created via public–private partnership. ITX connects local tourism SMEs (tour operators, attractions, accommodations) with online distribution channels. Focus on building a digital ecosystem so that even small tourism providers in rural areas can be booked online via OTAs and other apps. Includes inventory management and payment integration for vendors. | Launched & expanding: Initial launch 2018, integrated with Pigijo startup. By 2020, platform onboarded hundreds of tourism products, including those in "10 New Balis" priority destinations. Adoption grew during pandemic as businesses sought online sales. In 2023, ITX is being enhanced for better user interface and more partnerships with major OTAs. Still in expansion phase, government continues to promote vendor sign-ups and is considering incorporating ITX into a unified national tourism app. |
| Ministry of Tourism & CE: Wonderful Indonesia Digital Tourism Campaigns (E.g., #FromHome Virtual Tours, Interactive Marketing). | Primastahta, 2022 | A suite of digital campaigns to maintain tourism interest and engage audiences online during COVID-19. Included #TravelTomorrow virtual tours, 360° videos of destinations, AR filters and challenges on Instagram, and "Wonderful Indonesia from Home" content series. Utilized influencer collaborations and user-generated | Implemented (Adaptive): Launched in 2020 when borders closed, successful in generating millions of views for virtual tour videos and high social media engagement. Continued into 2021–2022 with virtual cultural festivals and online travel fairs. By 2023, these digital campaign elements have been integrated into regular marketing: |

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| Institution & Initiative | References | Program Description & Digital Focus | Implementation Status (2025) |
|---|---|---|---|
| | | content contests to virally promote destinations on social media. Post-pandemic, shifted to hybrid promotions (mix of virtual and on-ground). | every major tourism event has a strong online component (livestreams, AR experiences). The Ministry's digital marketing budget and capacity have increased, institutionalizing these innovations beyond the pandemic context. |

### 3.2.4. Chatbot and virtual-assistant services

Conceptual and qualitative studies designed for the Gili Islands illustrate how destination chatbots can push pro-environmental behaviors during and beyond the trip, a promising approach for fragile island ecosystems that need scalable, low-cost visitor guidance (Majid, Tussyadiah, & Kim, 2025; Majid et al., 2024). Large-sample models report that AI chatbot use positively affects planning satisfaction and visit intentions, suggesting DMOs can deploy conversational agents as a first-line, always-on interface to field inquiries and reduce friction along the decision journey (Orden-Mejía et al., 2023). Field evidence from Bali indicates chatbots improve real-time assistance and engagement but also underscores the need for language inclusivity, trust-building design, and supportive policy to extend adoption among smaller operators (Anak Agung Gede Wijaya, 2025). Experimental and applied pilots, from marine-tourism promotion to general post-pandemic information access via Telegram bots demonstrate feasible, low-budget pathways for regions to deploy assistants without heavy infrastructure (Fibriasari et al., 2024; Hamdan, Romli, Auliana, & Permana, 2024). Complementing these findings, proceedings on AI-based recommendations link chatbot output directly to destination visit intentions, a persuasive channel for youth markets accustomed to instant, personalized answers (Hidayah, Hurriyati, & Hendrayati, 2024).

### 3.2.5. Augmented Reality (AR) and Virtual Reality (VR) experiences

Youth-centric studies in Yogyakarta show that Instagram-based AR filters can convey heritage information and promote responsible behaviors among Gen-Z tourists, indicating that lightweight, social-native AR is an effective outreach format for both urban and heritage settings (Ramadhan, 2024). Indonesian work during the pandemic documents how virtual tours matured into credible communication and experience channels and now function as complements to on-site products, extending reach while reducing pre-trip uncertainty (Kinseng, Kartikasari, Aini, Gandi, & Dean, 2022). In parallel, Procedia Computer Science reports on AR for Indonesian culture highlight strong potential for awareness and education, readily transferable to museums and sensitive heritage assets (Aldo Arista et al., 2023). Broader tourism studies discuss VR's roles in sustainability and accessibility, offering lower-impact previews for ecologically sensitive areas and alternative access for audiences with mobility or cost constraints. Both highly relevant to Indonesia's remote or protected sites (Sharma et al., 2024). Regional creative projects, including AR literacy tools in North Sumatra and reviews of AR application practices, suggest that co-creation with local creatives can scale immersive storytelling across provinces while retaining cultural authenticity (Arasid, Yusuf, Zakaria, & Yusuf, 2023; Hadi, Tansliova, Hutagalung, & S, 2025).

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## 4. NEW CONCEPTUAL CONTRIBUTION: THE R-S-A-E FRAMEWORK

We synthesize a R-S-A-E framework: Rails, Services, Activation '! Equity outcomes; linking state capabilities to inclusion metrics in tourism:

- Rails: coverage, latency, affordability; presence of national standards (QRIS), and data plumbing (SPBE/Satu Data).
- Services: availability, quality, and interoperability of public platforms (ITX, e-VOA, DMS, protected-area booking, city/village apps).
- Activation: MSME onboarding, youth skills, DMO capacity, data stewards, communications.
- Equity outcomes: (i) Access (rural user/merchant digital participation rates), (ii) Economic uplift (MSME revenue dispersion, seasonality smoothing), (iii) Experience quality (wait times, satisfaction, accessibility), (iv) Environmental stewardship (carrying-capacity compliance), (v) Evidence-based governance (frequency/quality of data use in decisions).

The framework reframes "smart tourism" as state capability sequencing rather than technology procurement. It positions ministries and local governments as market shapers, setting rails and rules that crowd-in private innovation while ensuring distributional gains reach 3T areas. Table 4 anchor the framework to sectoral levers (RPJMN, Renstra, CHSE, DPSP, Smart City, ADWI/BETI-DEWI) that map onto R, S, and A.

**Table 5.** Tourism development & sector-specific policies (with digital components)

| Policy / Program | Years | Lead agency | What it does (for digital tourism) | Status / notes | Sources |
|---|---|---|---|---|---|
| RPJMN 2020–2024 (National Development Plan) | 2020– 2024 | Ministry of National Development Planning | Puts tourism and digital transformation as national priorities; guides ministry plans, Super Priority Destinations (DPSP), infrastructure. | Implemented via sectoral Renstra and programs. | (President of Republic of Indonesia, 2020) |
| Ministry of Tourism and Creative Economy Strategic Plan (Renstra) 2020–2024 | 2020– 2024 (amende d 2022) | MoTCE (Ministry of Tourism and Creative Economy / Tourism and Creative Economy Agency) | Shifts from traditional to digital tourism management; emphasizes digital marketing, platforms, and recovery. | Amended by Ministerial Reg. No. 11/2022. | (Kemenparekraf / Baparekraf, 2022; Menteri Pariwisata dan Ekonomi Kreatif / Kepala Badan Pariwisata dan Ekonomi Kreatif Republik Indonesia, 2022) |

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| Policy / Program | Years | Lead agency | What it does (for digital tourism) | Status / notes | Sources |
|---|---|---|---|---|---|
| CHSE standards & certification | 2020 – 2022 → ongoing practice | MoTCE | Health-safety quality scheme adopted widely; paired with online info/ verificatio n to rebuild traveler trust and enable platform listings. | Permenparekraf 13/2020 (CHSE) later superseded by financing/follo w-up rules in 2022. | (Menteri Pariwisata dan Ekonomi Kreatif / Kepala Badan Pariwisata dan Ekonomi Kreatif - Republik Indonesia, 2020, 2022) |
| e-VOA | 2022 – present | Directorate General of Immigration (Ministry of Law and Human Rights) | End-to-end online visa on arrival & gateway payments— cuts friction for foreign tourists; aligns with cashless travel. | e-VOA effective Nov 10, 2022; payment via PMK 157/2022; DG circulars issued. | (Kementerian Imigrasi dan Pemasyarakatan, 2022) |
| Super Priority Destinations (5 DPSP) | 2020 – present | Ministry of Tourism and Creative Economy / Coordinating Ministry for Maritime Affairs and Investment | Accelerated development at Borobudur, Lake Toba, Mandalika, Labuan Bajo, Likupang— pushes digitization of visitor services, content, and sales. | Active promotion and packaging; integrates with digital campaigns. | (Kementerian Pekerjaan Umum, 2024) |
| Movement Towards 100 Smart Cities | 2017– present (ongoing adoption) | Ministry of Communication s and Informatics (with local governments) | City masterplans include smart tourism modules (apps, portals, analytics) to enhance urban destination experience. | Ongoing mentoring; national guideline available. | (Direktorat Jenderal Aplikasi Informatika, 2021; Komdigi, 2020) |
| Tourism Village initiatives (ADWI & BETI DEWI) | 2021– present | Ministry of Tourism and Creative Economy | Competition & marketplace onboarding for tourism village; drives digital promotion, OTA onboarding, QR codes, youth content creation. | ADWI annual since 2021; BETI DEWI activations in 2024+ across regions. | (Kemenparekraf/ Baparekr af RI, 2021, 2024) |

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## 5. WHERE THE DIVIDE PERSISTS, AND THE REASON

Despite visible progress, several structural frictions keep Indonesia's urban–rural digital divide from fully closing. Last-mile and affordability barriers persist: while the national backbone exists, device costs, signal reliability, and data prices still constrain uptake for rural residents and micro-operators. Interoperability and content fidelity remain weak, with inconsistent village listings across OTAs and official portals reflecting the absence of reliable writeback/read-back standards and insufficient incentives for continuous data upkeep. Capacity asymmetries also matter: DMOs with thin staffing struggle to sustain DMS operations, curate and update chatbot knowledge bases, and run analytics, meaning activation lags behind rails and service rollouts. Evaluation gaps compound these issues, as many initiatives lack causal evidence (such as stepped-wedge or difference-in-differences designs), linking digitization to MSME income, employment, or load-shifting away from over-touristed sites. Inclusionbydesign is uneven too, with limited attention to language diversity, accessibility needs, and gendered constraints in rural contexts that shape who can train, transact, or participate. Finally, governance and trust are important: scaling MPD/DMS depends on privacy safeguards, dataminimization, and vendor contracts aligned with SPBE/Satu Data; without these, localities hesitate to share data.

## 6. ACTIONABLE IMPLICATIONS FOR PUBLIC MANAGERS

A practical near-term package can address these frictions. First, institutionalize a "Tourism MSME Starter Pack" that bundles onboarding to the core ecosystem (QRIS merchant IDs, ITX listings, basic Google/OTA name-address-phone hygiene, and inclusion in village-app catalogs), delivered through ADWI/BETI-DEWI roadshows. Complement this with funded local "tourism data owners" mandated under SPBE to maintain canonical POI and event feeds with service-level update commitments. Provide a cloud-hosted, privacy-by-design DMS template (including queues, time-slots, carrying-capacity and revenue dashboards), prepackaged with standard data-sharing clauses and privacy impact tools. Open up multilingual knowledge bases for transport, permits, emergencies, and environmental rules via APIs, and certify chatbots that guarantee instant human handoff. Seed village creator studios with microgrants to produce AR filters, short-form video, and 360° assets aligned with heritage and environmental codes. In parallel, adjust policy and procurement rules so money follows integration and inclusion: condition tourism grants on demonstrable co-movement of rails, services, and activation (no funding for a new app absent a data-steward plan and MSME onboarding targets); require data reciprocity in OTA partnerships so corrected village content flows back to public feeds; and embed accessibility and language criteria (WCAG conformance, Bahasa plus relevant regional languages, and plain-language content) into every digital tourism procurement.

## 7. A MEASUREMENT PROPOSAL: THE TOURISM DIGITAL INCLUSION SCORECARD (TDIS)

To translate intentions into outcomes, track a Tourism Digital Inclusion Scorecard at district and village levels. Access would capture the share of rural POIs with live bookability, the proportion of merchants transacting on QRIS, and a composite of mobile coverage and affordability. Economic uplift

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would monitor median monthly digital revenue for MSMEs, dispersion via a Gini of digital takings, and the share of bookings originating from non-urban areas. Experience quality would be assessed through average queue and wait-time variance at priority sites, first-contact resolution rates on chatbots, and app uptime. Environmental stewardship would record the percentage of days destinations operate within carrying capacity and the proportion of visitors completing pro-environment prompts. Evidence use would count DMO decisions each quarter that cite MPD/DMS analytics. Together, these indicators offer administrators a strategy that focuses on inclusive results rather than proxy metrics like app downloads or campaign impressions.

## 8. RESEARCH GAPS AND AGENDA

Future work should close the evidence gap on impact and equity.

- Priority one is causal identification (using designs such as difference-in-differences, instrumental variables, or stepped-wedge rollouts) to estimate how bundled onboarding (QRIS + ITX + listing hygiene) affects MSME revenue and employment in rural settings.
- A second line of inquiry is scaling behavioral pushes, with randomized trials on chatbot prompts for environmental compliance and off-peak redirection.
- Third, comparative fieldwork is needed on MPD governance across provinces to determine which contractual, organizational, and privacy arrangements sustain lawful, high-quality inputs to DMS.
- Fourth, researchers should center equity-by-design, combining qualitative and quantitative methods to understand language, accessibility, and gendered barriers in village digitization, and to test which design and pricing choices bend adoption curves for women-led and indigenous MSMEs.
- Finally, coupled human–natural systems models should link DMS controls (such as time-slotting and caps) to ecological indicators in protected areas, clarifying how digital management can protect sensitive environments while broadening inclusive access.

## CONCLUSION

Indonesia's experience shows that inclusive smart tourism emerges not from isolated technologies but from the coordinated advance of Rails–Services–Activation: connectivity, standards and data plumbing; interoperable public platforms; and systematic MSME/youth onboarding and institutional capacity. Evidence across apps, QRIS payments, DMS/MPD, chatbots, and AR/VR indicates meaningful gains in access for Gen-Z/Millennial travelers and rural SMEs, better operational control at destinations, and broader market reach; yet persistent last-mile constraints, content and data interoperability issues, and uneven local capabilities keep the urban–rural digital divide from fully closing. Our review contributes an actionable RS-A-E logic linked to measurable Equity outcomes, operationalized through the proposed Tourism Digital Inclusion Scorecard (TDIS), and points to a near-term policy package: bundled MSME onboarding (QRIS+ITX+listing hygiene), funded local data stewards, template DMS with privacy-by-design, open knowledge bases for certified chatbots, and micro-grants for immersive content. To shift from pilots to population-level impact, governments should condition grants and partnerships on R-S-A co-movement and accessibility criteria, while

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researchers prioritize causal designs on MSME incomes and jobs, scaled behavioral nudges, robust MPD/DMS governance, and equity-by-design in rural programs. Delivering these bundles, rather than sequencing siloed projects, offers the most credible path to narrowing Indonesia's urban–rural digital divide while advancing competitive, sustainable, and youthcentered smart tourism.

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