

A Corridor-Based Integration Model for Tourism Village Development in the Malang–Batu Tourism Corridor

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Abstract

The Malang–Batu corridor is a high-volume tourism system in East Java, but economic benefits remain concentrated in large commercial attractions while tourism villages operate as fragmented peripheral destinations. This study formulates a corridor-based integration model that combines smart tourism, community-based tourism (CBT), environmental protection, and cross-regional governance. A mixed-methods design was applied across five tourism-village loci representing gateway, magnet, and buffer functions. Data comprised a survey of 400 tourists, stakeholder interviews, hexahelix focus-group discussions, structured observation, policy documents, spatial data, and village plans. Analysis used GIS overlay, a Tourism Village Readiness Index, GAP and SWOT–IFAS/EFAS analysis, and the Analytical Hierarchy Process (AHP). Three integration barriers were identified: cross-administrative policy divergence, LP2B conversion of 3.2% per year against a 1.5% spatial-plan threshold, and a digital divide affecting 39.7% of surveyed tourists. Economic leakage occurred through supply chains (45–55%), accommodation (IDR 200,000–400,000 per tourist per night), and external asset ownership. The corridor was positioned in Quadrant I ($X = 0.92$; $Y = 0.85$). AHP prioritized collective partnerships and local cooperatives (0.1415), followed by a tri-regional joint BUMD and joint regulation (0.1305). The proposed Chain Tourism Corridor model assigns gateway, core, and explorer functions to destination nodes and links them through integrated information, visitor, and benefit flows. The model indicates that governance and distributive equity must precede large-scale physical and digital investment.

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INTRODUCTION

The Malang–Batu corridor is a strategic tourism system in East Java that links Malang City as an urban gateway, Batu City as a tourism and agropolitan magnet, and Malang Regency as a rural and ecological hinterland. The source study reports approximately 13.14 million annual visits across the corridor, comprising 9.7 million visits to Batu City and 3.44 million visits to Malang City in 2025. Despite this volume, visitor expenditure is not distributed proportionately across the corridor. Large, commercially operated attractions capture a substantial share of demand, whereas tourism villages with local knowledge, cultural practices, and agritourism landscapes remain weakly connected to the regional tourism value chain. This problem is consistent with the rural-tourism literature, which emphasizes that rural destinations require integrated product development, local ownership, and linkages to wider destination systems (Lane, 1994; Murphy, 1985).

The research gap is therefore not limited to the underutilization of village potential. It concerns the absence of a systemic corridor model that integrates spatial connectivity, community-based tourism, digital information, and cross-jurisdictional governance. Destination planning theory treats access from markets, internal circulation, and gateways as interdependent components rather than isolated

infrastructure elements (Gunn & Var, 2002; Baggio et al., 2010). In contrast, tourism-village planning is often implemented as a set of individual destinations. The Malang–Batu corridor demonstrates why this approach is insufficient: its destination nodes are functionally interdependent but administratively separated across Malang City, Batu City, and Malang Regency.

Three issues make the integration problem urgent. First, strategic assets such as accommodation and attraction facilities are frequently controlled by external investors, creating economic leakage and limiting residents' participation to low-value employment. Community-based tourism is relevant as a distributive and institutional approach, but participation is constrained by operational, structural, and cultural barriers when local communities lack information, skills, finance, or decision-making authority (Murphy, 1985; Tosun, 2000; Scheyvens, 1999). Second, conversion of Sustainable Food Agricultural Land (LP2B) in foothill areas threatens both agritourism and upstream water-catchment functions. Sustainable tourism must be treated as a negotiated limit on development rather than as a promotional label (Saarinen, 2006; Choi & Sirakaya, 2006). Third, the commercialization of cultural traditions without appropriate safeguards may weaken authenticity and intensify social inequality.

The policy context is also fragmented. The study examines the relationship among Law No. 18 of 2025 on Tourism, East Java Provincial Regulation No. 4 of 2022 on Tourism Village Empowerment, East Java Provincial Regulation No. 10 of 2023 on the Provincial Spatial Plan for 2023–2043, and the national and provincial instruments available during the study period. The 2026 National Tourism Development Index instrument is treated cautiously because the official ministry record located for this manuscript identifies it as a draft regulation rather than an established legal basis. These instruments recognize community participation, destination quality, digitalization, and spatial sustainability, but their implementation still requires coordination across administrative boundaries (Government of Indonesia, 2025; East Java Provincial Government, 2022, 2023; Ministry of Tourism, 2026).

A second theoretical stream concerns smart tourism. Smart tourism is not equivalent to the introduction of a promotional application; it is an information ecosystem that connects tourists, destinations, enterprises, and governance through data and technology (Gretzel et al., 2015; Buhalis & Amaranggana, 2015; Xiang & Gretzel, 2010). A third stream concerns collaborative governance. Cross-sector and cross-jurisdictional tourism planning requires institutional arrangements that can coordinate stakeholders, distribute benefits, and manage competing interests (Jamal & Getz, 1995; Timur & Getz, 2008; Hall, 2011). The contribution of this study is to synthesize these perspectives into an operational corridor model and to prioritize implementation through AHP with cross-regional stakeholders.

Accordingly, this study aims to: (1) analyze the performance of five tourism-village loci and identify policy, spatial, digital, and distributive barriers; (2) formulate a corridor-based integration model that combines smart tourism, standardized CBT capacity building, environmental protection, and stakeholder governance; and (3) develop implementable policy instruments, a five-year roadmap, and conflict-mitigation strategies. The study is positioned within the sustainable and agropolitan development agenda for Greater Malang and is relevant to SDGs 1, 8, and 15.

METHODS

The study employed a mixed-methods design in which quantitative and qualitative evidence were integrated through triangulation. The study area was the approximately 25-km northern corridor of Greater Malang. Five loci were selected purposively to represent three functional zones: Kayutangan Heritage Village in Malang City as the gateway zone; Tulungrejo and Pandanrejo Tourism Villages in Batu City as the magnet zone; and Donowarih and Toyomarto Tourism Villages in Malang Regency as the buffer or hinterland zone. Field activities were conducted during a four-month period in 2026 and comprised secondary-data collection, a preliminary survey, primary-data collection, analysis, and stakeholder validation.

Primary data were collected through four techniques. First, a structured questionnaire was administered to tourists. The minimum sample was calculated using the Slovin formula with a population of 13,140,427 and a 5% error tolerance; 400 valid responses were ultimately obtained and distributed across Greater Malang. Second, in-depth interviews were conducted with village officials, tourism-village managers, tourism offices in the three jurisdictions, and community leaders. Third, focus-group discussions involved hexahelix stakeholders representing government, academia, business, community, media, and financial institutions. Fourth, structured observation was used to assess accessibility, amenities, attraction management, digital services, and land-use conditions. Secondary data consisted of RPJMD and RTRW documents, regional regulations, BPS statistics, BPN spatial data, and village planning documents.

A tourism village was defined as an administrative territorial unit within the corridor that possesses distinctive natural, cultural, or man-made attractions and is managed through local institutions such as Pokdarwis or BUMDes, with an emphasis on CBT-based empowerment. Village tourism referred to the products and activities located within the village, including fruit picking, cultural education, and homestays. Tourism-corridor integration referred to the synchronization of governance between primary destinations and buffer villages within a single regional value chain. Four dimensions were assessed: spatial connectivity, functional integration through packages and supply chains, institutional integration through joint regulation, and digital integration through an information platform.

Analysis proceeded through six instruments. First, descriptive analysis mapped destination-performance profiles. Second, qualitative content analysis was applied to seven principal policy instruments from the national to the regional level. Third, GIS overlay analysis mapped route connectivity, economic nodes, and land-conversion pressure against LP2B delineations. Fourth, a Tourism Village Readiness Index used a 1–5 Likert scale across ten variables, combining the 4A components (attraction, accessibility, amenity, and ancillary services) with the Ministry of Tourism and Creative Economy's ADWI criteria. The index classified villages into Pioneer, Developing, Advanced, and Self-Reliant strata. Fifth, GAP analysis compared performance and importance, while SWOT analysis with IFAS/EFAS weighting determined the strategic position of each locus and the corridor. Sixth, AHP ranked ten alternative programs against three criteria: inclusive economic impact (0.40), environmental sustainability and LP2B protection (0.35), and digital readiness (0.25). The AHP consistency threshold was set at $CR \leq 0.10$, following Saaty's framework (Saaty, 1980).

Findings were validated through source–method triangulation and expert-judgment FGDs involving the Quality Control Team, tourism experts, and relevant

Regional Government Agencies (OPD). Because the source manuscript does not report an institutional ethics-approval number or a detailed informed-consent protocol, these details should be supplied by the authors before submission to a journal that requires them. The absence of such information does not alter the descriptive results, but it limits the methodological completeness of the manuscript.

RESULTS AND DISCUSSION

3.1 Performance profile and typology of corridor tourism villages

The five loci displayed complementary tourism typologies within one regional system. Tulungrejo was characterized by apple agritourism covering approximately 900 ha at an elevation of 1,150 m above sea level, with 74.26% of village land devoted to agriculture. Pandanrejo combined strawberry agritourism with the Raharjo BUMDes through its Lumbung Stroberi unit and Bantengan performing arts. Donowarih and Toyomarto combined nature-based and cultural tourism associated with Singhasari heritage and local handicrafts, while Kayutangan Heritage represented urban heritage tourism. Under the classification used in the study, Kayutangan Heritage was Advanced; Tulungrejo and Pandanrejo were Developing; and Donowarih and Toyomarto were in the Pioneer–Developing stage. The latter two institutions remained in consolidation, and Donowarih's Pokdarwis, established in 2024, did not yet have a structured work program.

Table 1. Profile and strategic position of the five study loci

Stage	Locus	Region / zone	Primary potential typology	Stratum	Model role	IFAS–EFAS quadrant
1	Kayutangan Heritage Village	Malang City / Gateway	Urban heritage tourism, culinary tourism, creative economy	Advanced	Gateway node	I (Aggressive)
2	Tulungrejo Tourism Village	Batu City / Magnet	Apple agritourism; 900 ha; 1,150 m asl; 74.26% agricultural land	Developing	Core node	I (Aggressive)
3	Pandanrejo Tourism Village	Batu City / Magnet	Strawberry agritourism; Raharjo BUMDes Lumbung Stroberi; Bantengan	Developing	Core node	I (Aggressive)
4	Donowarih Tourism Village	Malang Regency / Buffer	Arjuno-slope nature tourism; tubing; Pokdarwis established in 2024	Pioneer–Developing	Explorer node	II (Turnaround)
5	Toyomarto Tourism Village	Malang Regency / Buffer	Singhasari heritage; Sumberawan Temple; batik; cobek and sandal handicrafts	Pioneer–Developing	Explorer node	II (Turnaround)

Aggregate IFAS–EFAS weighting produced Cartesian coordinates of $X = 0.92$ and $Y = 0.85$, placing the Malang–Batu Tourism Village Corridor in Quadrant I, or an aggressive/growth-oriented position. Kayutangan Heritage, Tulungrejo, and Pandanrejo also occupied Quadrant I, whereas Donowarih and Toyomarto occupied Quadrant II, or a turnaround position. The main weakness of the latter two loci was the limited diversity of attraction offerings. GAP analysis showed that negative values were

concentrated in service digitalization, attraction management, and accessibility infrastructure in the hinterland villages. MSME product prices also exceeded tourist expectations in several locations; Toyomarto recorded the highest performance score of 4.62 and a gap of +0.61.

3.2 Integration barriers: policy, spatial, and digital

The policy analysis indicates that the macro-regulatory framework is comparatively progressive, but implementation and local synchronization remain weak. Three barriers were identified. First, Malang City, Malang Regency, and Batu City do not yet share a binding joint regulation governing revenue sharing and visitor flows. Second, provincial LP2B protection is exposed to accommodation-investment pressure at the regency and city levels, leaving pioneer tourism-village managers uncertain about Building Approval (PBG) compliance. Third, the digitalization requirement associated with tourism-village advancement is not matched by equitable infrastructure, and network blank spots persist in mountainous areas of Malang Regency.

Table 2. Policy instruments and their implications for corridor integration

Policy instrument	Relevance to tourism villages	Corridor implication	Implementation barrier
Law No. 18/2025 on Tourism	Formalizes tourism-village strata and introduces tourism-financing provisions	Provides a legal basis for fiscal and non-fiscal incentives for pioneer and developing villages	Technical arrangements for distributing relevant allocations to village treasuries remain unclear
Minister of Tourism draft Regulation No. 1/2026 on IPKN	Proposes periodic assessment using national tourism-development indicators	Encourages investment in hygiene, safety, and digitalization	Draft status and regional scores may not reflect the readiness of hinterland villages
East Java Regulation No. 4/2022	Positions communities as CBT subjects and links digitalization to village development	Can accelerate digital literacy and non-cash payment among local managers	Mountainous internet blank spots and lack of cross-regional procedures
East Java Regulation No. 10/2023 (RTRW 2023–2043)	Designates strategic spatial directions for agropolitan and sustainable tourism	Supports intermodal transport integration and water-catchment protection	Inconsistent LP2B zoning and PBG conflicts across jurisdictions

Spatially, the corridor consists of gateway, buffer, and magnet zones and is organized around two circulation axes. The western axis (Klojen–Lowokwaru–Karangploso–Junrejo–Batu) experiences chronic weekend congestion, with travel times of 45–75 minutes. The northern axis (Singosari–Karangploso–Bumiaji) could function as an alternative route but has not been sufficiently promoted. Land-conversion pressure was substantial: active rice fields in Karangploso decreased from 1,823 ha in 2019 to 1,654 ha in 2024 (-9.3%), while horticultural land in Junrejo decreased from 2,140 ha to 1,978 ha (-7.6%). The estimated average LP2B conversion rate was 3.2% per year, more than twice the 1.5% tolerance threshold used in the East Java RTRW. Without effective controls, the study projects that 35% of active agricultural land in the corridor could change function within ten years. This projection should be interpreted as a scenario rather than a deterministic forecast.

The digital divide was also pronounced. Of surveyed tourists, 39.7% were unaware of any Greater Malang tourism application or website, and 28.8% knew of such platforms but considered them unhelpful. Only Kayutangan Heritage had active public Wi-Fi and an integrated website. Pandanrejo used a semi-structured WhatsApp

booking system, Donowarih and Toyomarto remained largely manual, and all villages maintained Instagram accounts without standardized content strategies.

Table 3. Summary of corridor integration barriers

Dimension	Key finding	Quantitative indicator
Policy	Cross-regional divergence; no joint regulation among the three regional heads; PBG–LP2B conflict	Seven policy instruments analyzed; zero cross-administrative joint regulations
Spatial / LP2B	Agricultural-land conversion driven partly by tourism accommodation on the Karangploso, Singosari, and Junrejo slopes	3.2% per year versus a 1.5% RTRW threshold; Karangploso -9.3%; Junrejo -7.6% (2019–2024)
Digitalization	Information platforms have low visibility; booking remains manual; social-media content is inconsistent	39.7% unaware of platforms; 28.8% rated them unhelpful; one of five loci had public Wi-Fi
Connectivity	Western-axis congestion, underused northern axis, and isolated hinterland	Travel times of 45–75 minutes; road access to Donowarih 90% and Toyomarto 85%; no scheduled tourist transport

3.3 Economic leakage and social risks

The distribution of tourist expenditure indicates that 27.1% of tourists were day visitors without an overnight stay, while 23.7% stayed overnight in Malang City, 22.4% in Batu City, and 26.6% in Malang Regency. Souvenir and culinary spending, however, was concentrated in Malang City (36.8%), despite many attractions being located in Batu City and Malang Regency. The pattern indicates leakage from the magnet and buffer zones toward the gateway zone.

Three leakage mechanisms were identified. Accommodation leakage occurred because some visitors to Tulungrejo and Pandanrejo selected city-center hotels when village homestays did not meet expected comfort standards, creating a potential loss of IDR 200,000–400,000 per tourist per night. Supply-chain leakage was estimated at 45–55% of consumption expenditure in Tulungrejo because apple and strawberry products sold at tourism kiosks were supplied by distributors rather than local farmers. Asset-ownership leakage was evident around Donowarih, where only two of eight glamping facilities were owned by local residents and six were controlled by investors from Malang, Surabaya, or Jakarta. Social risks were also associated with the takeover of the Budug Asu natural tourism area by an external party and the possible erosion of customary values through commercialization without sacred zoning.

3.4 Chain Tourism Corridor integration model

The synthesis of the analyses produced an Operational Corridor Integration Model based on the Chain Tourism Corridor concept. Each tourism village functions as a node in the corridor value chain. Kayutangan Heritage is the gateway node and entry point for visits and information; Tulungrejo and Pandanrejo are core nodes and agritourism anchors; and Donowarih and Toyomarto are explorer nodes offering more authentic, lower-density alternatives. The model operates through three flows: information flow through an integrated real-time platform; tourist flow through dynamic routing and cross-node packages such as One Day Three Villages and One Attraction One Village; and benefit flow through transparent revenue sharing. Service consistency is supported by five joint SOPs covering guest reception, guide hand-off, carrying-capacity management, single-channel complaints, and real-time reporting.

limited. Toyomarto showed a more positive pattern because village-government support encouraged participation in Singosari batik training and heritage-based tourism packages.

Four tiered training modules were formulated. The first concerns homestay and hospitality management based on CHSE standards for homestay owners in Toyomarto and Tulungrejo. The second concerns MSME partnership and governance for sponge-sandal and cobek artisans in Toyomarto, with licensing as the intended output. The third concerns creative digital marketing for Karang Taruna youth and Pokdarwis managers. The fourth concerns cultural storynomics for local guides, focusing on educational narratives about Sumberawan Temple and the Kirab Tirta Amerta Sari ritual.

The digital pillar is intended to bridge information-access gaps through four components: an interactive spatial-routing map; smart booking and e-ticketing linked to major OTAs and traffic information; a transparent single-gateway QRIS system managed by the joint BUMD; and multimedia digital storytelling and cultural archives. The platform is expected to increase length of stay through stay-in-the-city, play-in-the-village packages, direct revenue flows into village treasuries, and spatial analytics that can inform infrastructure policy.

3.6 Instruments for mitigating economic leakage and social conflict

The model includes five quantified measures to reduce economic leakage: (1) subsidized CHSE certification and BUMDes renovation loans, with a target of increasing homestay occupancy from 35% to 65% by 2028; (2) a Corridor Tourist Farmers and Suppliers Cooperative with stable price–volume contracts and a target of sourcing at least 70% of culinary and souvenir inputs within a 10-km radius; (3) a Village Regulation on Tourism Investment that requires at least 30% local ownership; (4) Fair Tourism packages intended to direct at least 80% of tourist expenditure to village communities; and (5) a public-facing BUMDes digital accounting system that reports revenue in real time.

Three instruments address social conflict. First, customary law and sacred zoning would prohibit commercial development within 500 m of sacred sites such as Sumberawan Temple and Sumber Pentungan Sari in Toyomarto. Second, BUMDes-based collective-share partnerships would require residents to hold at least 51% ownership in the use of village treasury land by investors. Third, an automatic cultural-preservation fund equivalent to 15% of each integrated package transaction would support customary rituals and performing arts. These instruments are governed through hexahelix collaboration, with the tri-regional joint BUMD acting as the professional corridor operator.

3.7 Program prioritization and implementation roadmap

The ten alternative programs were ranked using AHP. The consistency test was satisfactory ($\lambda_{\max} = 11.15$; $CI = 0.1279$; $CR = 0.0858 \leq 0.10$). The global priority synthesis is presented in Table 4.

Table 4. AHP-based prioritization of corridor programs

Rank	Alternative program	Economic (0.40)	Environmental (0.35)	Digital (0.25)	Global score
I	Collective partnership and local cooperatives (Tourism Hub)	0.25	0.09	0.04	0.1415
II	Joint BUMD and joint regulation of the three regions	0.18	0.11	0.08	0.1305
III	Integrated PBG regulation and Village LP2B Regulation	0.09	0.18	0.04	0.1090
IV	Storynomics digital marketing and Wi-Fi blank spots	0.06	0.02	0.29	0.1035
V	Integrated digital platform and Hub Tourism map	0.06	0.03	0.26	0.0995
VI	Sustainable-destination certification and cultural protection	0.05	0.15	0.10	0.0975
VII	Karanglo Rest Area Hub as a transit hub	0.15	0.06	0.05	0.0935
VIII	Spatial engineering of the northern alternative route	0.11	0.09	0.06	0.0905
IX	LP2B-zone supervision and slope carrying-capacity restrictions	0.02	0.20	0.02	0.0830
X	CHSE homestay and BUMDes financial-HR training	0.03	0.07	0.06	0.0515

The AHP priorities were translated into a five-year roadmap. Year 1 focuses on institutional and regulatory consolidation, including the Joint Regulation of Three Regional Heads, the joint BUMD, a supply-chain cooperative, a Village LP2B Regulation, and PBG supervision. Year 2 focuses on the Hub Tourism platform, fifteen free Wi-Fi points, storynomics, and digital and financial training. Year 3 focuses on the Karanglo Rest Area, shuttle and jeep fleets, northern-route signage, and cross-regional circular packages. Year 4 focuses on CHSE homestay certification, hotel-cooperative supply contracts, collective shares, and alignment between RKPD and IPKN indicators. Year 5 focuses on institutional self-reliance, sustainable tourism certification, youth regeneration, transparent digital dividends, and a 1.5% poverty-reduction target across the five loci.

Table 5. Summary of the five-year implementation roadmap

Stage / year	Program focus	Primary responsibility	Key KPIs
1 / 2026	Institutional and regulatory consolidation: joint regulation, joint BUMD, supply-chain cooperative, Village LP2B Regulation, PBG supervision	Bappeda and BRIDA East Java; legal divisions; tourism and cooperative offices; Satpol PP; village governments and BUMDes	One joint regulation; one BUMD; active cooperatives in five loci; zero zoning violations
2 / 2027	Information system and digital literacy: Hub Tourism, Wi-Fi blank spots, storynomics, digital and financial training	Communication and Information Office; Disporapar; universities; BUMDes/Pokdarwis; Karang Taruna	Platform released; 15 Wi-Fi points; 12 training sessions; +1.5 digital-readiness score
3 / 2028	Spatial engineering and connectivity: Karanglo Hub, shuttle/jeep fleets, route signage, circular packages	Transportation and PUPR offices; destination division; jeep operators; ASITA East Java	70% hub completion; 30 fleets; 40 signs; at least three circular packages on national OTAs
4 / 2029	Service standardization and partnership: CHSE homestays, hotel-cooperative contracts, collective shares, RKPd-IPKN alignment	Tourism offices; PHRI; cooperatives and BUMDes; Bappeda and BKD	80% CHSE homestays; 15 hotel contracts; 65% occupancy; +12% IPKN infrastructure score
5 / 2030	Self-reliance and sustainability: carrying capacity, certification, youth regeneration, transparent dividends	Environment offices; BPK regional office; joint BUMD; village managers and Karang Taruna	Approximately zero protected-area damage; five nationally certified loci; -1.5% poverty

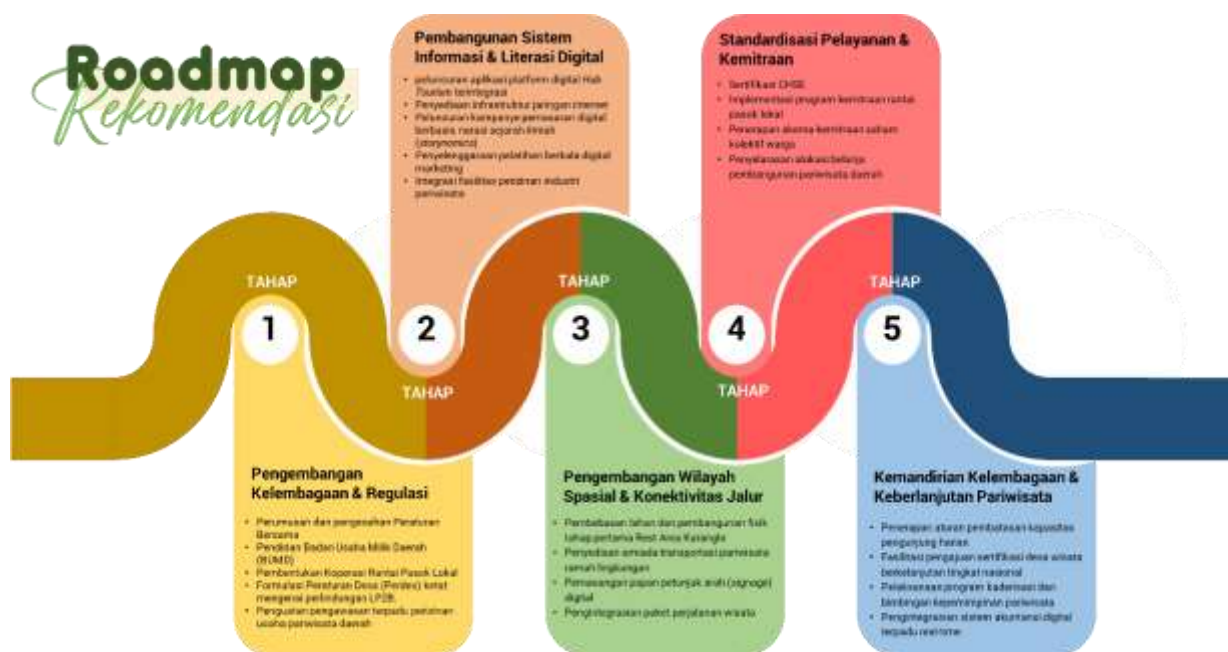


Figure 3. Five-year implementation roadmap

4. Discussion

4.1 Integration, not potential, is the central development problem

The findings indicate that the principal challenge facing tourism villages in the metropolitan corridor is not a lack of attractions but a lack of integration. The Quadrant I IFAS–EFAS position suggests that internal strengths and external opportunities already exist; the missing element is an institutional architecture that connects

destination nodes across three jurisdictions. This interpretation is consistent with destination planning theory, which treats market access, internal circulation, and gateways as systemic elements that cannot be managed in isolation by one local government (Gunn & Var, 2002; Baggio et al., 2010). The Chain Tourism Corridor model extends that framework by assigning gateway, core, and explorer functions and by directing visitor spillovers from the saturated magnet zone toward under-visited hinterland nodes.

4.2 CBT must address ownership and value distribution

The estimated 45–55% supply-chain leakage and the dominance of external asset ownership support the long-standing critique that mass tourism does not necessarily retain added value locally. They also confirm the relevance of CBT as a structural approach rather than a training program alone. Participation without ownership may leave local residents with limited bargaining power, a problem documented in developing-country tourism settings (Tosun, 2000; Scheyvens, 1999). The model therefore translates CBT into ownership instruments: collective BUMDes shares, minimum local ownership in investment partnerships, a local supply-chain cooperative, Fair Tourism packages, and a cultural-preservation fund. The AHP ranking of collective partnership and cooperatives above physical and digital infrastructure suggests that stakeholders view distributive equity as a prerequisite for integration.

4.3 Smart tourism as governance infrastructure

The finding that 39.7% of tourists were unaware of a regional information platform exposes a policy paradox: digitalization is expected to support destination upgrading while infrastructure and human-resource capacity remain uneven. The proposed Hub Tourism platform is consequently designed as governance infrastructure, not merely as a marketing application. Dynamic routing can support road-load management; single-gateway QRIS can automate revenue reconciliation and reduce cash-based leakage; and a real-time dashboard can provide evidence for infrastructure and visitor management. This approach reflects the smart-tourism literature's emphasis on connected information ecosystems and personalized, data-enabled services rather than technology adoption in isolation (Gretzel et al., 2015; Buhalis & Amaranggana, 2015; Xiang & Gretzel, 2010).

4.4 Environmental limits and spatial staging

The estimated LP2B conversion rate of 3.2% per year represents a dual risk to the economic basis of agritourism and to the hydrological functions of Greater Malang's upstream areas. The study therefore treats LP2B control as a tourism-integration instrument rather than as a separate agricultural agenda. Relocating amenity concentration to the Karanglo Hub is intended to reduce development pressure on protected slopes. This position is consistent with sustainability approaches that view ecological limits as active conditions shaping tourism development, not as post-hoc evaluation criteria (Saarinen, 2006; Choi & Sirakaya, 2006).

The Karanglo Rest Area also functions as a staging area in destination management. It can intercept private vehicles near the Surabaya–Malang toll exit, relieve the western-axis congestion, and redistribute visitors through shuttle and jeep services. The relatively balanced overnight-stay shares across the three jurisdictions, contrasted with the concentration of souvenir spending in Malang City, indicate that accommodation interventions alone will not equalize benefits. Local-product nodes and circular packages must be placed along the northern route so that the buffer zone captures secondary spending.

4.5 Governance sequencing

The proposed tri-regional joint BUMD is an institutional intervention intended to overcome the weak binding force of inter-regional memoranda. A jointly governed enterprise could provide legal legitimacy for revenue management, professional continuity, and automatic revenue-sharing reconciliation. The AHP rank of II (0.1305) indicates that stakeholders view the joint institution as a critical enabling condition for the digital platform, transit hub, and supply-chain programs. The roadmap therefore places institutional consolidation before large physical and digital investments. This sequencing reflects collaborative-governance scholarship, which emphasizes stakeholder coordination and institutional capacity as conditions for sustainable destination management (Jamal & Getz, 1995; Timur & Getz, 2008; Hall, 2011).

4.6 Limitations and future research

Four limitations should be acknowledged. First, the tourist sample was concentrated in the two main cities, so visitors to specific hinterland villages may be underrepresented. Second, AHP weights were derived from a regional expert FGD; although mathematically consistent ($CR = 0.0858$), they remain context dependent. Third, economic-leakage estimates are indicative because they are based on interviews and observation and have not been validated with a regional input–output table. Fourth, several projections, including the ten-year land-conversion scenario and the target shares for local ownership, are planning assumptions rather than observed causal effects. Future research should test the elasticity of visit distribution under dynamic routing, validate leakage through regional input–output analysis, and measure the longitudinal effects of collective-share schemes on village-household resilience.

CONCLUSION

This study produces five principal outputs. First, it develops an Operational Corridor Integration Model based on the Chain Tourism Corridor concept, assigning gateway, core, and explorer functions to Kayutangan Heritage, Tulungrejo and Pandanrejo, and Donowarih and Toyomarto, respectively. Second, it produces a GIS-informed corridor typology that identifies the northern axis as a congestion-relief route and integrates LP2B protection into development control. Third, it formulates a Smart Tourism Framework based on a single-gateway platform with an e-catalog, interactive routing, smart booking, and integrated QRIS. Fourth, it develops a five-year roadmap with institutional responsibilities and measurable KPIs. Fifth, it applies a Tourism Village Readiness Index to differentiate interventions across the five loci.

The central conclusion is that tourism-village integration in a metropolitan corridor requires three simultaneous corrections: institutional correction, from fragmented jurisdictions toward joint governance; structural-economic correction, from leakage toward collective local ownership; and spatial-ecological correction, from uncontrolled expansion toward development bounded by LP2B and carrying capacity. The AHP prioritization of collective partnerships and joint institutions indicates that governance architecture and distributive equity should precede large-scale physical and digital investment.

Policy implementation should therefore begin with the Joint Regulation of the Three Regional Heads, the tri-regional joint BUMD, supply-chain cooperatives, and safeguards for LP2B and cultural sites. These institutional measures should be followed by digital infrastructure, spatial connectivity, CHSE standardization, and

community ownership mechanisms. The approach offers a transferable framework for other tourism corridors in which high visitor volumes coexist with fragmented governance and uneven local benefit distribution.

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