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A Collaborative Digitalization Model for Strengthening Sustainable Tourism Ecosystems: An Agency Approach to Tourism Enterprises in Central Java

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Abstract

Introduction. The global tourism sector, contributing 10.3% to world GDP (UNWTO, 2024), is undergoing structural shifts driven by digital transformation, sustainability demands, and evolving tourist expectations. Although the pentahelix model is positioned as an ideal multi-stakeholder framework, its top-down implementation often remains rhetorical and fails to translate into concrete actions—particularly in Indonesian destinations where collaboration tends to be ceremonial. Methods. This participatory action research applied a mixed-methods sequential explanatory design involving 85 tourism business operators in Central Java (January-November 2025). A five-phase intervention was implemented: awareness building, digital capacity development (presence, engagement, distribution, conversion), collaborative design workshops, technical implementation support, and continuous monitoring. Data were collected through pre–post competency tests, participatory observations, three FGDs, digital artifact analysis, and digital metrics tracking. Analyses used paired t-tests, thematic analysis, and methodological triangulation Results. Bottom-up, industry-initiated collaboration substantially improved sustainability competence by 41.9% (M=58.3→82.7; p<0.001; d=2.21). Digital engagement metrics increased markedly: likes +156%, comments +203%, shares +187%, reach +142%, and Google Business Profile views +134%. Five tangible outputs emerged: an integrated event calendar coordinating 24 events; eight cross-destination bundled packages generating IDR 387 million and increasing length of stay from 1.2 to 2.3 days; a shared digital platform attracting 3,847 unique visitors and 78 direct bookings; standardized service protocols; and peer-learning networks. Conclusion. Community-driven digital collaboration effectively shifts competitive mindsets toward cooperative partnerships, with digital tools functioning as coordination infrastructure. The "Industry as Trigger–Pentahelix as Enabler" framework demonstrates that pentahelix activation occurs organically when grounded in evidence. Future research should conduct longitudinal assessments and cross-destination comparisons.

KEYWORDS

sustainable tourism, digital transformation, pentahelix model, community-driven collaboration, tourism digitalization, experience economy.

Introduction

According to UNWTO (Tourism, 2024) the global tourism sector contributes 10.3% of world GDP and creates 1 in 10 jobs, yet faces unprecedented transformation pressures. The global tourism sector confronts fundamental restructuring triggered by three major catalysts of change (Flanigan et al., 2014). The first dimension relates to the metamorphosis of consumer behavior that comprehensively integrates digital

ecosystems into the tourism experience curation process (Rodrigues et al., 2024a). As a manifestation of this digital transformation, contemporary travelers conduct extensive research through digital review aggregators, visual social media platforms, and online travel agent marketplaces to shape their travel decisions. The second dimension reflects escalating expectations toward tourism practices responsive to sustainability pillars—encompassing ecological preservation, social justice, and long-term economic viability (Darmina Wandik et al., 2025; Widianti, 2020). The industry can no longer rely on extractive models but must internalize responsibility toward ecosystem regeneration and local community empowerment. The third dimension marks the transition of tourist expectations from passive visual consumption toward immersive conceptual experiences and co-creation (Kusumadewi et al., 2023). This Experience Economy 2.0 paradigm indicates that value propositions no longer reside in physical infrastructure but in narratives, emotions, and moments reproducible as digital social capital.

Digital technology in tourism contexts is operationalized through four strategic dimensions: digital presence facilitating discoverability(Benyon et al., 2014) ; digital engagement building affective relationships with destinations (Singgalen, 2024); digital distribution integrating transactional channels (Tandafatu et al., 2024); and digital conversion optimizing data intelligence-based funnels (Kurolov et al., 2025). Although the pentahelix model—configuring synergies among government, academia, business sector, civil community, and media—conceptually offers an ideal framework for stakeholder orchestration, its implementation faces systemic constraints. Sectoral interest fragmentation, translational research deficits, and policy dissonance result in collaborative initiatives frequently halting at discursive dimensions without action materialization (Bratić et al., 2025; Rodrigues et al., 2024b).

Based on the preceding situational analysis, a gap can be identified between theoretical conceptualization of the pentahelix collaboration model and field implementation reality, where multi-party collaboration in sustainable tourism development remains suboptimal and tends to stagnate at discourse levels (Dananjaya, 2025). This condition generates the need for alternative models that are more operational, responsive, and based on concrete action, particularly through digital technology utilization and community-driven approaches among business operators. Therefore, this research addresses three main research questions: (1) How effective is the digital collaboration model initiated by business operator communities in accelerating tourism ecosystem capacity? (2) Through what mechanisms can digital technology facilitate concrete collaboration realization among tourism industry actors? (3) To what extent can business operator collaborative initiatives contribute as catalysts in activating pentahelix configurations to realize destination sustainability?

This research aims to evaluate the effectiveness of digital collaboration models based on community-driven approaches, identify digital technology roles as collaborative infrastructure, and analyze contributions of industry collaborative actions as triggers for pentahelix activation. Theoretically, this research contributes to strengthening implementative pentahelix models based on agency approaches, which have been minimal in empirical literature. Practically, this research offers collaboration blueprints replicable by other destinations to enhance tourism competitiveness and sustainability. Unlike previous research focusing on top-down pentahelix model evaluations (Bratić et al., 2025; Rodrigues et al., 2024a), this research offers innovative approaches by positioning industry actors as prime movers and utilizing digital technology as collaborative infrastructure—aspects still minimal in Indonesian tourism empirical literature.

Literature Review

Sustainable Tourism Paradigm

The concept of sustainability in tourism contexts refers to destination development approaches aimed at anticipating and mitigating negative impacts on three main dimensions—ecological, socio-cultural, and economic—while simultaneously maximizing positive contributions to local community welfare and destination asset preservation. In the ecological dimension, sustainability encompasses maintenance of essential ecological processes, biodiversity protection, and environmental carrying capacity management to ensure that pressures from tourist visits do not exceed ecosystem regenerative capabilities (Made Suniastha Amerta Made Sara Kompiang Bagiada, 2018; Noer Fida Yanik et al., 2024). In the socio-cultural dimension, sustainability emphasizes active community participation as owners of cultural values and local identity, equitable economic benefit distribution, and appreciation of local wisdom as part of tourism experiences (Tabak et al., 2025). Meanwhile, in the economic dimension, sustainability demands long-term viability through stable income, local job creation, multiplier impacts for MSMEs, and poverty alleviation based on tourism activities (Rahayu, 2011; Zhang & Ali, 2024).

Conceptually, sustainable tourism is understood not merely as efforts to minimize negative impacts but as an integrative strategy linking environmental conservation, local community empowerment, and destination economic growth through multi-party collaboration (Loupias et al., 2023). However, recent studies reveal gaps between theoretical sustainability principles and implementation practices at Indonesian tourism destinations. Research by (Muhamad et al.,2024) found that sustainability monitoring remains weak due to minimal data-based observatory systems. Meanwhile, systematic studies by Muda (Muda, 2025) reveal that community participation in tourism management is often symbolic and has not generated equitable economic benefit distribution. These conditions indicate that sustainable tourism success depends on structured collaboration mechanisms, based on concrete actions, and supported by digital infrastructure as tools for strengthening governance, transparency, and participation.

Sustainable tourism development not only minimizes negative footprints but also creates synergies among environmental conservation, community empowerment, and destination economic prosperity within collaborative stakeholder frameworks (Loupias et al., 2023). Therefore, sustainability principle applications must be integrated into every aspect of destination management—from planning, implementation, monitoring to evaluation—to generate real and maintainable long-term transformations(Noer Fida Yanik et al., 2024).

Digital Transformation in Tourism Ecosystems

Digital transformation constitutes one crucial element accelerating modern tourism industry competitiveness. Tourism digitalization is understood not merely as technology adoption but as comprehensive integration of information and communication technology (ICT) into tourism value chains to enhance marketing effectiveness, operational efficiency, tourist experiences, and destination economic performance (Agustian et al., 2023; Elia et al., 2024). This transformation shapes new paradigms centered on data-driven tourism ecosystems, where strategic decisions are determined by digital consumer behavior and preference analytics.

In implementation, tourism digitalization is represented through four fundamental integrated pillars. The first pillar is Digital Presence, namely destination or business operator capabilities to appear and be easily found in digital spaces through search engine optimization, functional websites, and tourist review-based reputation management (Benyon et al., 2014). Strong digital visibility influences information accessibility for tourists while forming initial perceptions of

destination quality. Capabilities to build credible digital appearances become prerequisites for increasing tourist trust before traveling. The second pillar is Digital Engagement, namely meaningful interactions built through creative content, experience storytelling, and community engagement strategies that enhance affective tourist relationships with destinations. Strong and consistent interactions demonstrably increase positive sentiment and purchasing preferences, as shown by research (Singgalen, 2024).finding that visual storytelling strategies significantly impact increased tourist engagement and digital word-of-mouth.

The third pillar is Digital Distribution, encompassing multi-channel distribution system integration through online travel agents (OTAs), metasearch engines, direct booking platforms, and social commerce. Digital distribution system integration enables destinations to reach broader markets while reducing friction in customer journeys from searches, price comparisons, to ticket and reservation transactions (Tandafatu et al., 2024). Connected distribution channels strengthen marketing diversification impacting increased occupancy and destination revenues. The fourth pillar is Digital Conversion, namely capabilities to transform digital interactions into real transactions through conversion funnel optimization strategies, tourist journey personalization, and data analysis utilization for insight-based decision-making (Kurolov et al., 2025). Effective conversion connects digital engagement with real economic impacts, becoming indicators of destination digitalization success.

Various recent studies show that destinations implementing four digital pillars comprehensively experience significant increases in marketing performance, tourist visits, and aggregate revenues (Bratić et al., 2025). Digitalization demonstrably becomes collaboration enablers among industry actors while serving as strategic instruments for developing sustainable, inclusive, and competitive tourism in the Experience Economy 2.0 era.

Pentahelix Model Reconfiguration: From Top-Down to Bottom-Up

The pentahelix framework conceptually positions five institutional actors—government as policy regulators and facilitators, academics as knowledge creators and evidence-based research providers, industry or business actors as value creators and economic drivers, communities or civil society as beneficiaries and cultural guardians, and mediaas amplifiers and strategic narrative disseminators in public spaces. This model is viewed as an ideal instrument for multi-actor collaboration orchestration in sustainable tourism development (Bratić et al., 2025; Rodrigues et al., 2024a) However, conventional top-down implementations frequently fail to generate substantive collaboration due to minimal ownership, government intervention dependence, and weak agency of industry actors as main actors in the field(Widén-wulff & Ginman, 2004). Many collaborative initiatives halt at ceremonial and discourse levels without real transformations in operational practices.

As an alternative, this research proposes pentahelix model reconfiguration based on bottom-up approaches, positioning tourism industry actors as initiators and prime movers, while government, academics, media, and communities serve as system enablers activated by momentum and concrete performance evidence generated by business operators (Bratić et al., 2025). This reformulation follows subsidiarity principles, namely that best decisions and actions are taken by actors closest to operational realities, and collective efficacy principles in change management emphasizing collaborative capacities based on trust and mutual benefits (Bandura et al., 1999; Wood & Bandura, 1989). Thus, collaboration no longer depends on vertical bureaucratic structures but on transformational energy from industry actor communities driving pentahelix to move responsively and adaptively.

Experience Economy and Value Co-Creation

The Experience Economy 2.0 paradigm marks shifts from service economy toward economy of experiences, where consumers no longer merely purchase services or products but desire *memorable events* and meaningful *transformative experiences* (Kusumadewi et al., 2023). In tourism contexts, this means destination or tourism business operator value propositions must shift from focus on physical facilities and amenities (tangible amenities) toward intangible experiences that are authentic, shareable (Instagrammable), and possess strong emotional resonance. Conversely, the Value Co-Creation concept emphasizes that tourists are not merely passive consumers but active participants in constructing their own tourism experiences. This process demands industry actors to design touchpoints and interactions facilitating tourist participation, experience personalization, and higher involvement (Buhalis et al., 2020; Haider & Co-creation, n.d.; Widén-wulff & Ginman, 2004; Zulfan Zulkarnaen Z & Agung Winarno, 2025). Related concept literature shows that higher tourist involvement levels in co-creation (including through digital activities, community interactions, and local experiences) generate greater satisfaction and perceived value (Megawati et al., n.d.; Pane et al., 2025). Thus, destination development needs to formulate strategies enabling tourists not only to consume tourism products but also to participate in creating shared experiences—through dialogue, cultural interactions, digital technology, and personalization—thereby creating shared value strengthening destination competitive advantages in the experience economy.

Research Gap and Positioning

Although literature regarding pentahelix collaboration (Bratić et al., 2025), sustainable tourism development(Loupias et al., 2023), and digital transformation (Elia et al., 2024) has developed rapidly, three main gaps constitute this research focus: First, most pentahelix studies are descriptive-evaluative toward government-initiated top-down implementations, with minimal evidence regarding bottom-up approach effectiveness based on industry initiatives (Dananjaya, 2025; Widén-wulff & Ginman, 2004). Second, although tourism digitalization has been extensively examined from marketing and customer experience perspectives(Rodrigues et al., 2024a; Singgalen, 2024), digital technology roles as multi-actor collaborative infrastructure remain underexplored. Third, action research studies intervening and measuring concrete impacts of digital collaboration at Indonesian artificial tourism destinations remain very limited.

This research fills these gaps by: (1) testing bottom-up collaboration models based on community-driven approaches; (2) operationalizing digital technology as collaborative infrastructure, not merely promotional tools; and (3) using mixed-methods action research to generate replicable evidence-based models.

Conceptual Research Framework

Based on literature synthesis, this research proposes three main propositions:

P1: Community-driven approach-based digital collaboration models significantly enhance digital capacity and sustainability understanding among tourism industry actors.

P2: Digital technology functions as collaborative infrastructure facilitating concrete collaboration materialization among industry actors.

P3: Industry actor collaborative initiatives generating evidence-based outcomes can activate pentahelix stakeholder engagement organically without top-down interventions.

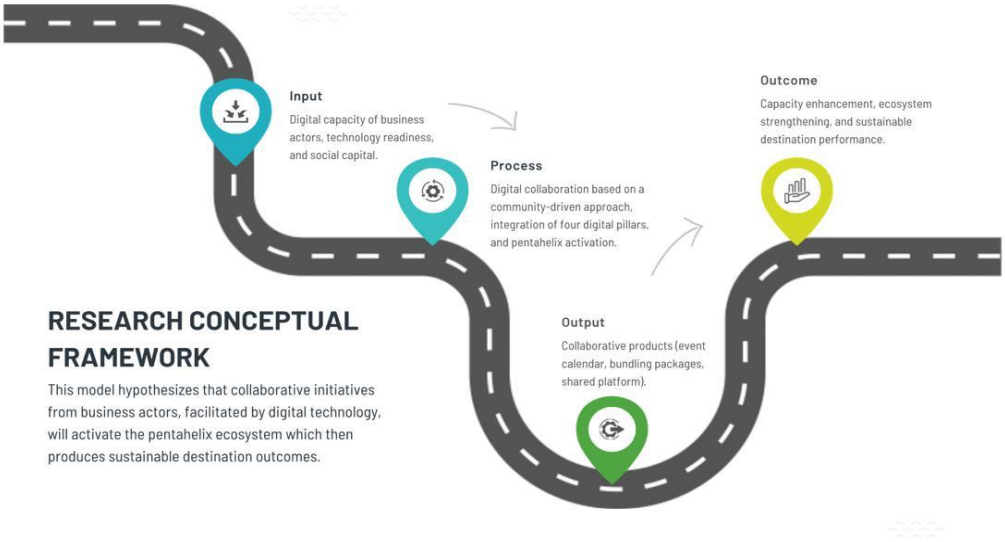

Figure 1. Research Framework

Figure 1 posits that collaborative initiatives by business actors, facilitated by digital technology, will drive the pentahelix ecosystem, ultimately leading to sustainable outcomes for the destination.

Methods

Research Paradigm and Design

This research adopts an action research paradigm with Participatory Action Research (PAR) approaches, chosen for alignment with research objectives to not only generate academic findings but also intervene in practical realities to produce transformative changes in tourism ecosystems (Gorontalo, n.d.; Kamal et al., 2024) The research design employs mixed-methods sequential explanatory design, where quantitative and qualitative data are collected complementarily and integrated at analysis stages to strengthen validity through triangulation.

Research Setting and Context

Research was conducted in Surakarta City (Solo), Central Java from January to November 2025. Locations were chosen purposively based on considerations: (1) concentration of consolidated artificial tourism industry actors, (2) geographic accessibility enabling cross-regency/city representation, and (3) digital infrastructure readiness to support intervention implementation. Study contexts focus on tourism business operator communities affiliated with DPD PUTRI Central Java, encompassing artificial tourism destination managers, hotels, restaurants, MSMEs, and tour operators.

Research Participants

Participants comprised 85 tourism industry actors selected using purposive sampling techniques, namely non-random participant selection in which researchers intentionally determine samples based on specific criteria aligned with the research objectives (Sofatur Rizky et al., 2023; Tajik et al., 2024) The inclusion criteria included active business operations, affiliation with the DPD PUTRI membership, and full willingness to participate in the study. with criteria: active business operations, DPD PUTRI membership affiliation, full participation willingness, and business category diversity. Participant composition consists of: artificial tourism destination managers (62%), accommodation operators (18%), culinary/F&B business operators (12%), and tour service operators & supporting MSMEs (8%). *Baseline digital readiness assessment*s showed 73% possessed basic digital literacy, yet only 24% implemented structured digital marketing strategies (figure 3).

Data Collection Procedures

Data collection in this research was conducted through five complementary sources to strengthen methodological triangulation. First, pre-post competency tests were used to measure digital capacity increases and sustainability understanding. Second, participatory observations were conducted with direct researcher involvement to document collaborative dynamics and learning processes. Third, Focus Group Discussions (FGD) were conducted in three sessions to explore perceptions, challenges, and inter-business operator collaboration strategies. Fourth, digital artifact documentation analysis was conducted on content and digital activities generated by participants. Fifth, digital metrics analysis was used to measure implementation impacts through *reach*, *engagement*, *conversion* data, and digital traffic from social platforms and Google Analytics. This multi-source approach strengthens finding validity through source and technique triangulation, consistent with recommendations (Creswell & Poth, 2018; Kelle et al., 2019) in mixed-method research.

Intervention Protocol

Training and collaboration interventions were implemented through five phases designed gradually to promote capacity enhancement and real collaboration implementation (Figure 2):

Phase 1: Awareness & Readiness Building (4 hours) - Socialization of digital tourism transformation and *Experience Economy 2.0* plus initial digital readiness assessment.

Phase 2: Capacity Building on Digital Strategies (6 hours) - Direct practical training on four digital pillars: *digital presence, digital engagement, digital distribution,* and *digital conversion*.

Phase 3: Collaboration Design Workshop (4 hours) - Facilitation of concrete collaboration co-design through potential mapping, *resource sharing*, and role distribution.

Phase 4: Technical Implementation Assistance (2 hours) - Technical assistance in shared digital platform application and service standardization.

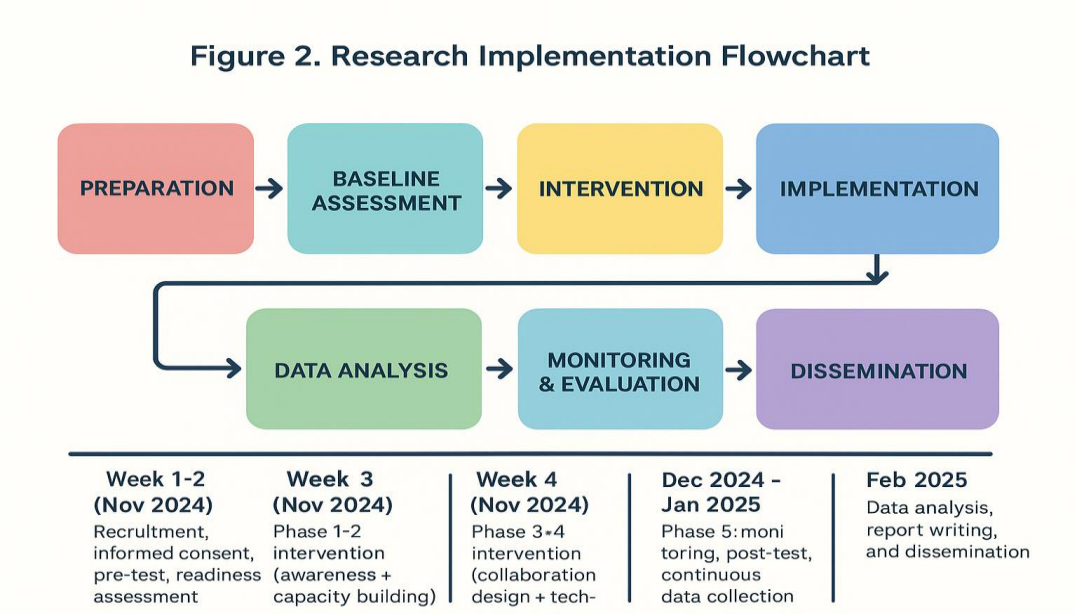

Figure 2. Research Implementation Flowchart

Figure 3. Research Methods

Phase 5: Monitoring and Evaluation - Continuous monitoring through digital KPI formulation, monitoring *dashboards*, and *feedback loops*.

This staged intervention model aligns with *action-based collaborative learning* approaches (Kemmis et al., 2014; Creswell & Poth, 2018).

Data Analysis Strategy

Data analysis employed mixed methods approaches with quantitative and qualitative integration. Quantitative analysis was conducted using *paired t-tests* to measure pre-post competency score differences plus descriptive statistics to describe participant profiles and digital performance indicators. Qualitative analysis was conducted through *thematic analysis* on FGD and observation transcripts, plus *content analysis* on digital artifacts generated by participants. Both data integrations were conducted through triangulation and *joint display analysis* to ensure consistency and confirmation of inter-method findings (Creswell & Poth, 2018; Kelle et al., 2019).

Rigor and Trustworthiness

Data validity was maintained through source and method triangulation, *member checking*, and *peer debriefing*. Transferability was strengthened through *thick descriptions* regarding research contexts. Dependability was ensured through *audit trails* and systematic process documentation. Confirmability was maintained using *reflexive journals* and *external audits*. These principles refer to trustworthiness criteria (Ahmed, 2024).

Ethical Considerations

Research obtained institutional ethical approval and all participants signed *informed consent*. Participants were guaranteed identity confidentiality rights, data security, and freedom to withdraw anytime without consequences. *Beneficence* and *non-maleficence* principles were applied to ensure research did not generate negative impacts (Hafiza Sibarani & Albina, n.d.; Polonioli et al., 2023)

Result and Discussion

Participant Characteristics and Baseline Conditions

The research program involved 85 tourism business operators as active participants. Demographic composition showed female dominance (68%) with mean age 42.3 years (SD = 8.7), reflecting family-based business ownership characteristics in Central Java. Business experience among participants predominantly ranged from 5 to 15 years, suggesting a mature level of operational development. Based

on business categories, 53 participants (62.4%) managed artificial tourism destinations, 15 participants (17.6%) worked in accommodation, 10 participants (11.8%) in culinary sectors, and 7 participants (8.2%) were tour operators and supporting MSMEs. Baseline conditions showed that although 73% of participants already used social media for personal purposes, only 24% implemented structured digital marketing strategies. Most (61%) still relied on word-of-mouth and walk-in visitor promotions, only 15% had active business websites, and almost none utilized analytics as decision-making bases. In collaboration aspects, although all participants were affiliated with the same industry association, substantive inter-business operator interactions remained very limited. As many as 82% of participants had never conducted concrete business collaborations, and 67% still viewed fellow business operators as competitors, not collaboration partners. These baseline findings strengthen research gaps found in previous studies that pentahelix structures often experience stagnation due to minimal agent-driven collaboration.

Acceleration of Sustainability and Digitalization Competencies

Intervention result analysis showed significant increases in sustainability understanding and business operator digitalization capacities. Pre-test mean scores of 58.3 (SD = 12.4) increased to 82.7 (SD = 9.8) in post-tests with paired-samples t-test results $t(84) = 18.42$, $p < 0.001$, Cohen's $d = 2.21$, indicating very large effect sizes. Greatest increases occurred in economic sustainability dimensions (+52%), followed by socio-cultural (+45%), and environmental (+37%). These data show that participant understanding previously tended to focus on ecological issues, whereas economic and socio-cultural dimensions are actually important for destination sustainability remained poorly understood.

Table 2 shows that significant changes also occurred in digital competencies, as follows:

- Visual Content Creation: 66 participants (77.6%) could produce quality photo content, and 51 participants (60%) produced 15-60 second duration storytelling videos. Content quality scores increased from 2.3/5 to 4.1/5.

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Table 1. Paired-Samples T-Test Results for Pre-Post Intervention Competencies

Dimension	Pre-test M (SD)	Post-test M (SD)	T-Value	p-value	Cohen's d
Sustainability					
- Ecological	61.2 (9.8)	83.9 (8.2)	16.34	<.001	2.48
- Socio-cultural	54.8 (11.2)	79.4 (9.1)	17.89	<.001	2.41
- Economic	58.9 (13.5)	89.6 (8.7)	19.72	<.001	2.78
Digital Competence					
- Digital Presence	48.3 (14.1)	78.2 (10.3)	18.45	<.001	2.43
- Digital Engagement	52.7 (12.9)	81.5 (9.7)	17.23	<.001	2.52
- Digital Distribution	45.2 (15.3)	75.8 (11.2)	16.78	<.001	2.28
- Digital Conversion	41.6 (16.7)	72.3 (12.4)	15.92	<.001	2.15
Total Score	**58.3 (12.4)**	**82.7 (9.8)**	**18.42**	**<.001**	**2.21**

Note: N=85; df=84; p<.001 indicates statistical significance at α=0.001; Cohen's d > 0.8 indicates large effect size

Table 2. Pre-Post Implementation Digital Metrics Comparison

Digital Metrics	Pre (Weekly Average)	Post (weekly Average)	Change
Social Media Engagement			
Total Likes	1,247	3,193	+156%
Total Comments	342	1,036	+ 203%
Total Shares	198	568	+187%
Reach (Unique Users)	12,430	30,082	+142%
Google Business Profile			
Profile Views	8,234	19,270	+134%
Website Clicks	1,456	2,592	+78%
Direction Requests	823	1,580	+92%
Shared Platform			
Unique Visitors	-	3,847	New
Direct Bookings	-	78	New
Avg. Session Duration	-	4m 32s	New

Data taken from 4-week pre-intervention vs. 4-week post-implementation periods

Table 3. Collaborative Actions and Their Impacts

Collaborative Actions	Collaborative Actions	Collaborative Actions
Integrated Event Calendar	24 integrated events for 2025	Cross-promotion and tourism circuits preventing event overlap
Bundled Packages	8 cross-destination tour packages	127 transactions, IDR 387 million revenue, LoS increased from 1.2 → 2.3 days
Shared Digital Platform	3,847 unique visitors, 78 direct bookings	Integrated marketing hub among operators
Service Standardization	Joint SOPs for hygiene, facilities, response	Peer-monitoring and increased trust
Capacity Building Network	5 informal peer-learning sessions	Sustainable independent learning system

- Digital Ecosystem Management: 55 participants (64.7%) began uploading content consistently minimum 3 times weekly. Engagement increased significantly: likes +156%, comments +203%, shares +187%, reach +142%.
- Google Business Profile Optimization: 44 participants (51.8%) updated business profiles; views increased +134%, website clicks +78%, direction requests +92%.
- Data Literacy: 39 participants (45.9%) could read basic analytics as decision-making bases.

These findings confirm that practice-based training and direct assistance generate significant digital capacity acceleration, aligned with study findings by Singh & Kasim (2023) that experiential learning models are more effective than conventional training.

Concrete Examples of Cross-Industry Collaboration

This program facilitates the transition from abstract talk of collaboration to tangible, measurable collaboration. Some of the key outcomes of this collaboration are listed in Table 3

These findings affirm that result-oriented bottom-up collaboration is more effective than traditional coordination forums, because it generates real value and direct benefits for business operators (Table 1).

Multi-Stakeholder Ecosystem Activation

Business operator collaboration momentum successfully triggered other stakeholder involvement, proving hypotheses that pentahelix activation can develop organically when industry provides concrete evidence (evidence-based advocacy).

- Government responded with commitments to event calendar integration, regulatory simplification, and digital promotion support plans.
- Academics played roles in longitudinal research, best practice documentation, and scientific consultation.
- Media and communities engaged in amplification, documentation, and creative content production.

Stakeholder involvement without formal requests demonstrates that tangible achievements are more effective than proposals or discussion forums without action, supporting theses that industry as trigger, pentahelix as enabler constitute more applicable and sustainable models.

These research findings strengthen literature that community-based collaboration (community-driven collaboration) and digital empowerment constitute foundations for sustainable destination transformation. Digitalization functions not only as promotional tools but as coordination infrastructure simplifying multi-actor collaboration complexity. Additionally, research results affirm that pentahelix success highly depends on evidence-driven practice, not formal structures.

4.6 Integration of Findings with Theoretical Frameworks

These research findings provide empirical confirmation of several theoretical propositions while offering conceptual refinements:

First, bottom-up model success supports collective efficacy theory (Bandura et al., 1999) stating that groups with shared beliefs toward their collective capabilities will be more successful in achieving shared goals. He data show that 82% of participants initially viewed fellow operators as competitors but later regarded them as collaboration partners after observing clear mutual benefits.

Second, digital technology roles as collaborative infrastructure expand tourism digitalization concepts from Elia et al. (2024) previously focusing on value chain optimization. This research shows that digital technology also functions as coordination mechanisms reducing collaboration transaction costs—aligned with institutional economics perspectives.

Third, organic pentahelix activation through evidence-based advocacy confirms subsidiarity principles in collaborative governance, where decision-making is most effective when conducted by actors closest to operational realities (Wood & Bandura, 1989). Government, academic, and media involvement occurring responsively—not directively—shows that collaboration legitimacy is stronger when built upon performance evidence, not formal structures.

Fourth, value co-creation implementation in bundled package development and integrated experiences validates Experience Economy 2.0 framework (Kusumadewi et al., 2023), where tourists are no longer merely passive consumers but active participants in experience construction. Length of stay increases from 1.2 to 2.3 days show that co-created experiences generate higher perceived value.

Conclusion

This research generates three main contributions to the sustainable tourism body of knowledge:

Theoretical Contribution: This research introduces and preliminarily supports the "Industry as Trigger–Pentahelix as Enabler" model as applicable alternatives to conventional top-down approaches, providing empirical evidence that pentahelix activation can occur organically through evidence-based advocacy.

Methodological Contribution: Mixed-methods action research utilization with staged intervention protocols demonstrably effective in generating measurable transformations within relatively short timeframes, offering replication blueprints for other destinations.

Practical Contribution: This research generates implementative collaboration models demonstrably producing 5 concrete outputs with measurable economic impacts, enabling direct adoption by practitioners and policymakers.

This research demonstrates that community-driven digital collaboration models initiated by tourism industry actors demonstrably effective in enhancing digital capacity, strengthening cross-operator collaboration, and accelerating sustainability practice implementations at artificial tourism destinations in Central Java. Quantitative measurement results show sustainability competency increases of 41.9%, digital content quality increases and content distribution consistency, plus significant increases in engagement and digital business platform performance post-intervention.

Action research-based intervention programs successfully transformed business operator relationships from competitive orientations toward collaborative orientations, demonstrated through formation of 5 concrete collaborative actions, including integrated event calendars, cross-destination bundled packages, shared digital platforms, service standardization, and independent learning network formation. These outputs created measurable economic impacts, such as length of stay increases, bundled package sales revenue of IDR 387 million, and more equitable tourist flow increases among destinations.

Important research findings affirm that pentahelix activation need not begin through top-down approaches but can develop organically when industry actors as main actors present concrete data-based results (*evidence-based advocacy*). When collaboration processes generate real evidence, government, academic, community, and media involvement occurs automatically due to shared values and benefits. Thus, the “Industry as Trigger–Pentahelix as Enabler” model can be viewed as a more adaptive and applicable alternative approach for sustainable tourism development.

Additionally, this research affirms that digitalization is not merely promotional tools but constitutes collaborative

infrastructure simplifying coordination, transparency, accountability, and benefit distribution. Digital presence, engagement, distribution, and conversion demonstrably become four key pillars in strengthening competitive advantages and destination capacities in entering Experience Economy 2.0 eras, where tourists seek authentic, participatory, and emotionally valua ble experiences.

Local governments need to shift their approach by allocating special budgets to support bottom-up collaboration initiatives that demonstrate concrete evidence, rather than merely funding ceremonial events or discussion forums. In addition, licensing regulations and standardization need to be simplified to encourage collaborative innovation without reducing quality oversight aspects. Data integration and inter-stakeholder digital platforms also need to become strategic agendas in regional tourism development masterplans. Furthermore, it is essential to establish incentive schemes and matching funds for industry-led collaborative initiatives with proven economic and social impacts. As an innovative policy approach, regulatory sandboxes should be developed to allow new collaboration models to be tested before full-scale implementation.

From a practical perspective, industry actors can replicate the five-phase intervention protocols that have been demonstrably effective in this research, with appropriate contextual adjustments. Industry associations also need to evolve from membership-based organizations into collaborative networks that actively facilitate resource sharing and joint action. Investments in digital literacy and analytics capabilities should become short-term priorities to enhance destination competitiveness. Moreover, business operators should prioritize collaboration over competition, recognizing that collective success enhances individual performance. The development of peer-mentoring programs is also important, where digitally advanced operators support less experienced peers.

From an academic perspective, future research should conduct longitudinal studies within a 1–3 year timeframe to assess the long-term sustainability of collaborative models. Comparative studies across different destination types, including natural, cultural, and special interest tourism, as well as across different geographic regions, are also necessary. Furthermore, there is a need to develop technology acceptance models that are specific to the context of collaboration within the tourism industry. Future research should also investigate the critical success factors for scaling collaborative models to provincial or national levels.

This research has several limitations that need to be considered when interpreting the results. From a temporal perspective, the implementation and monitoring period of three months is relatively short for observing long-term impacts and the sustainability of collaboration, and therefore longitudinal studies of at least 1–2 years are required to confirm model sustainability. From a geographical perspective, the focus on artificial tourism destinations in Central Java limits the generalization of findings to natural or cultural destinations, or to regions with different socio-economic characteristics. From a sample perspective, although 85 participants are sufficiently representative for action research, this number remains limited for broader statistical generalization, particularly since all participants are members of a single association that may have unique characteristics. From a measurement perspective, economic impact assessment is still based on self-reports and aggregated digital platform data, and validation through independent financial data is needed to strengthen the robustness of the findings. In terms of external validity, the study was conducted in a post-pandemic context where motivation for collaboration and digitalization may be higher, and this condition needs to be considered in model replication. In addition, the study assumes relatively uniform access to digital infrastructure, which may not be applicable in regions with limited connectivity. Finally, the cultural context of Central Java, which emphasizes communal cooperation (gotong royong), may influence collaboration readiness levels, and therefore the findings may not be fully generalizable to other cultural contexts.

Based on the findings and limitations of this research, several future research agendas are recommended. Longitudinal studies are needed to measure collaboration sustainability and long-term impacts on destination performance within a 1–3 year timeframe. Comparative studies should also be conducted to test the model across different destination types and geographic regions in order to examine external validity. Further research is required to assess the economic impact of digital collaboration using quantitative approaches such as input-output analysis or computable general equilibrium methods to measure multiplier effects more accurately. In addition, the development of technology adoption models that consider local socio-cultural factors is essential. Research on scalability through action research at provincial or national levels is also necessary to identify success factors for large-scale implementation. Further investigation is needed to understand the psychological and social mechanisms that transform competitive orientations into collaborative orientations. Cross-cultural studies should also be conducted to examine whether the effectiveness of the model is universal or culturally specific. Finally, policy impact studies are required to evaluate government policy changes triggered by industry-led initiatives and their long-term sustainability impacts.

Author contributions

Hesti Widianti: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing - Original Draft, Writing - Review & Editing, Project Administration.

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References

251-Muhamad, Muhamad Baiquni, Wiryanto / Sustainable Tourism Observatories Framework at National Tourism Strategic Area Development / 251-266 (KSPN) in Indonesia. (2024a). https://doi.org/10.21632/irjbs

251-Muhamad, Muhamad Baiquni, Wiryanto / Sustainable Tourism Observatories Framework at National Tourism Strategic Area Development / 251-266 (KSPN) in Indonesia. (2024b). https://doi.org/10.21632/irjbs

Agustian, K., Mubarok, E. S., Zen, A., Wiwin, W., & Malik, A. J. (2023). The Impact of Digital Transformation on Business Models and Competitive Advantage. *Technology and Society Perspectives (TACIT)*, *1*(2), 79–93. https://doi.org/10.61100/tacit.v1i2.55

Ahmed, S. K. (2024). The pillars of trustworthiness in qualitative research. *Journal of Medicine, Surgery, and Public Health*, *2*, 100051. https://doi.org/10.1016/j.glmedi.2024.100051

Bandura, A., Freeman, W. H., & Lightsey, R. (1999). Self-Efficacy: The Exercise of Control. In *Journal of Cognitive Psychotherapy* (Vol. 13, Issue 2, pp. 158–166). https://doi.org/10.1891/0889-8391.13.2.158

Benyon, D., Quigley, A., O'Keefe, B., & Riva, G. (2014). Presence and digital tourism. *AI and Society*, *29*(4), 521–529. https://doi.org/10.1007/s00146-013-0493-8

Bratić, M., Marić Stanković, A., Pavlović, D., Pivac, T., Kovačić, S., Surla, T., Čerović, S., & Zlatanov, S. (2025). New Era of Tourism: Innovative Transformation Through Industry 4.0 and Sustainability. In *Sustainability (Switzerland)* (Vol. 17, Issue 9). Multidisciplinary Digital Publishing Institute (MDPI). https://doi.org/10.3390/su17093841

Buhalis, D., Andreu, L., & Gnoth, J. (2020). The dark side of the sharing economy: Balancing value co-creation and value co-destruction. *Psychology and Marketing*, *37*(5), 689–704. https://doi.org/10.1002/mar.21344

Creswell, J. W. ., & Poth, C. N. . (2018). *Qualitative inquiry and research design*. SAGE.

Dananjaya, A. G. (2025). Kolaborasi Pentahelix dalam Pengembangan Pariwisata Berkelanjutan di Ibu Kota Nusantara. *Masyarakat Pariwisata : Journal of Community Services in Tourism*, *6*(1), 30–47. https://doi.org/10.34013/mp.v6i1.1983

Darmina Wandik, Lazarus Ramandei, & Juliani Wairata. (2025). Dampak Penerapan Konsep Pariwisata Berkelanjutan Terhadap Masyarakat di Kampung Tobati Enggros Kota Jayapura. *Venus: Jurnal Publikasi Rumpun Ilmu Teknik*, *3*(3), 66–72. https://doi.org/10.61132/venus.v3i3.872

Elia, G., Solazzo, G., Lerro, A., Pigni, F., & Tucci, C. L. (2024). The digital transformation canvas: A conceptual framework for leading the digital transformation process. *Business Horizons*, *67*(4), 381–398. https://doi.org/10.1016/j.bushor.2024.03.007

Flanigan, S., Blackstock, K., & Hunter, C. (2014). Agritourism from the perspective of providers and visitors: A typology-based study. *Tourism Management*, *40*, 394–405. https://doi.org/10.1016/j.tourman.2013.07.004

Gorontalo, U. N. (n.d.). *MODEL PARTICIPATION ACTION RESEARCH DALAM PEMBERDAYAAN MASYARAKAT*. http://ejurnal.pps.ung.ac.id/index.php/AKSARA/index

Hafiza Sibarani, N., & Albina, M. (n.d.). Etika dalam Penelitian Pedidikan. *Jurnal Riset Ilmu Pendidikan Islam*, *2*(3), 10–21. https://doi.org/10.61132/karakter.v2i3.1099

Haider, A., & Co-creation, B. (n.d.). *Combined Effects of Brand Co- Creation , Customization on Brand Trust and Word-of-Mouth : Mediating Role of Perceiv …*

Kamal, B., Fauzi, A. Z., Widianti, H., & Sya'bani, M. (2024). Pemanfaatan Media Sosial Youtube Sebagai Sarana Bisnis Digital Marketing. *JMM (Jurnal Masyarakat Mandiri)*, *8*(2), 2259. https://doi.org/10.31764/jmm.v8i2.22274

Kelle, U., Kühberger, C., & Bernhard, R. (2019). How to use mixed-methods and triangulation designs: An introduction to history education research. *History Education Research Journal*, *16*(1). https://doi.org/10.18546/herj.16.1.02

Kurolov, M. O., Sobirjonov, S., & Jumayev, A. (2025). Impact of digital marketing in tourism industry: A data driven marketing analytics approach. *ACM International Conference Proceeding Series*, 859–863. https://doi.org/10.1145/3726122.3726246

Kusumadewi, R., Fitriadi, H., Fauzi Kartika Sari, A., Lufi Zulfikar, A., Yustitia Nurul Islami, P., Hellin Amrina, D., Badri, F., Fahrullah, rasy, Rasyid, F., Putra Timur, Y., Permata Sari, D., Arina Romli, N., Safitri, D., Fitria Mustapita, A., Gandhi Mahardika, S., Bte Badrul Munir, M., Badrul Munir, T., Nurul Islami, N., Pramono, W., … Irma Tripalupi, R. (2023). *BERBASIS DIGITAL*. https://Penerbitadab.id

Loupias, H. H., Larisu, Z., Budi Utomo, S., & Mardiah, A. (2023). *Sustainable Tourism Industry Concept and Implementation: Evidence from Indonesia *1*.

Made Suniastha Amerta Made Sara Kompiang Bagiada, I. I. (2018). Sustainable Tourism Development. *International Research Journal of Management*. https://sloap.org/journals/index.php/irjmis/article/view/176

Megawati, S., Noer, M., Al-Amin, F., Febrianti, E., & Rahayu, T. (n.d.). *Pentahelix Partnership in The Development of Sustainable Tourism in The Bojonegoro District*. https://doi.org/10.30589/proceedings.2024.1173

Muda, F. (2025). Community participation in Indonesian sustainable tourism: A systematic review of models, impacts, and gaps. *Priviet Social Sciences Journal*, *5*(8), 125–139. https://doi.org/10.55942/pssj.v5i8.462

Noer Fida Yanik, C., Ciptadi, G., Kurniawan, A., & Putra, F. (2024). Integration of Economic, Social, Environmental, and Public Health Aspects in Developing the Tourism Park Concept at the Pakusari Final Processing Site for Sustainable Tourism. *Transactions of the Chinese Society of Agricultural Machinery*, *55*(1). https://doi.org/10.62321/issn.1000-1298.2024.01.04

Pane, R. P., Nasution, H. F., Susanto, A., & Rafi, M. (2025). Pentahelix Model in Community Based Tourism Development: Roles, Challenges, and Synergy Enhancement. *Indonesian Journal of Tourism and Leisure*, *06*(2), 2025–2147. https://doi.org/10.36256/ijtl.v6i2.565

Polonioli, A., Ghioni, R., Greco, C., Juneja, P., Tagliabue, J., Watson, D., & Floridi, L. (2023). The Ethics of Online Controlled Experiments (A/B Testing). *Minds and Machines*, *33*(4), 667–693. https://doi.org/10.1007/s11023-023-09644-y

Rahayu, D. (2011). Perlindungan Hukum Terhadap Hak Cipta Motif Batik Tanjungbumi Madura. *Mimbar Hukum - Fakultas Hukum Universitas Gadjah Mada*, *23*(1), 115. https://doi.org/10.22146/jmh.16204

Rodrigues, V., Breda, Z., & Rodrigues, C. (2024a). The implications of industry 4.0 for the tourism sector: A systematic literature review. *Heliyon*, *10*(11). https://doi.org/10.1016/j.heliyon.2024.e31590

Rodrigues, V., Breda, Z., & Rodrigues, C. (2024b). The implications of industry 4.0 for the tourism sector: A systematic literature review. *Heliyon*, *10*(11). https://doi.org/10.1016/j.heliyon.2024.e31590

Singgalen, Y. A. (2024). Enhancing Tourism Digital Content Engagement through Sentiment and Toxicity Analysis: Application of Perspective, Vader, and TextBlob Models. *Journal of Computer System and Informatics (JoSYC)*, *5*(4), 987–1000. https://doi.org/10.47065/josyc.v5i4.5757

Sofatur Rizky, M., Aguspriyani, Y., & Studi Perbankan Syariah Fakultas Ekonomi Dan Bisnis Islam, P. (2023). TEKNIK PENGAMBILAN SAMPEL PURPOSIVE DALAM MENGATASI KEPERCAYAAN MASYARAKAT PADA BANK SYARIAH INDONESIA. *Neraca Manajemen, Ekonomi*, *3*. https://doi.org/10.8734/mnmae.v1i2.359

Tabak, B., Trišić, I., Štetić, S., Nechita, F., Ilić, M., Obadović, M., & Dobrescu, A. I. (2025). Economic and Socio-Cultural Development Dimension—Two Lake-Protected Areas' Sustainability: A Case of Hungary and Serbia. *Land*, *14*(3). https://doi.org/10.3390/land14030479

Tajik, O., Golzar, J., & Noor, S. (2024). | P a g e Purposive Sampling. In *IJELS* (Issue 2).

Tandafatu, N. K., Ermilinda, L., & Darkel, Y. B. M. (2024). Digital Transformation in Tourism: Exploring the Impact of Technology on Travel Experiences. *International Journal of Multidisciplinary Approach Sciences and Technologies*, *1*(1), 55–64. https://doi.org/10.62207/w3vsg352

Tourism, U. (2024). *World Tourism Barometer: September 2024 ***EXCERPT****. https://doi.org/10.18111/wtobarometereng

Widén-wulff, G., & Ginman, M. (2004). *Explaining knowledge sharing in organizations through the dimensions of social capital*. *January 2014*. https://doi.org/10.1177/0165551504046997

Widianti, H. (2020). *Potensi Ekonomi Kreatif Kabupaten Pemalang* (Hariyanto, Ed.; 1st ed.). Lembaga Pendidikan pelatihan Limamedia.

Wood, R., & Bandura, A. (1989). Social cognitive theory of organizational management special issue: theory development forum Dynamic Personality View project. *The Academy of Management Review*, *14*(3), 361–384. http://www.jstor.org/page/info/about/policies/terms.jsp

Zhang, Y., & Ali, Q. (2024). Socio-economic determinants of sustainable tourism and their nexus with energy, environment, and economy (3ES): A panel data analysis. *Energy Strategy Reviews*, *56*. https://doi.org/10.1016/j.esr.2024.101577

Zulfan Zulkarnaen Z, & Agung Winarno. (2025). Revitalisasi Branding Lokal Melalui Strategi Co-Creation: Studi Kasus Kopi Suling Khas Toraja dalam Menembus Pasar Urban. *Dinamika Publik: Jurnal Manajemen Dan Administrasi Bisnis*, *3*(1), 15–34. https://doi.org/10.59061/dinamikapublik.v3i1.1013