Otoritas : Jurnal Ilmu Pemerintahan Vol. 15, No. 3, 2025
DOI: https://doi.org/10.26618/ojip.v15i3.20036

Collaborative governance in green tourism village administration in Bali through SIDeWi*HuB

Deddy Kurniawan Halim[1*)], Susanti[2] , Faizal Madya[3], Ni Putu Tirka Widanti[4]
[1,2,3]*Department of Public Administration, Universitas Terbuka, Indonesia*
[4]*Department of Public Administration, Universitas Ngurah Rai, Indonesia*

Abstract

This study examines collaborative governance in Bali's Green Tourism Villages (Desa Wisata Hijau, DWH) as a strategy for post–COVID-19 rural tourism sustainability amid urban hotel oversupply and environmental degradation. A mixed-methods design was employed, combining quantitative survey data from 126 respondents across 28 tourism villages with qualitative–secondary analysis of policy documents, tourism statistics, and environmental reports to contextualize empirical findings beyond the village level. Quantitative data were collected through the SIDeWiHuB digital platform, which integrates sustainability assessment, village registration, and DeWiKu e-commerce services. Three constructs were measured using validated multi-item scales: Need for Green Village (N-GreenV), Community Participation (CP), and Perception of Sustainability (PS), derived from established sustainability and participatory tourism frameworks and benchmarked against normative standards developed from prior baseline studies. Internal consistency and construct validity were assessed before analysis. Multiple linear regression was applied, with diagnostic checks for normality, multicollinearity, and model fit conducted to ensure robustness. Results indicate that all sampled villages met the Kalpataru 5 (greenest) classification threshold. This findings demonstrate the analytical validity of SIDeWiHuB as a digitally enabled collaborative governance instrument within a Pentahelix framework and support its potential scalability as a policy tool for sustainable rural tourism governance in Indonesia.

Keywords: *green tourism village, collaborative governance, digital platform*

*)Corresponding author
E-mail : dkhalim70@gmail.com

Introduction

The COVID-19 pandemic has accelerated structural changes in Indonesia's tourism sector, shifting development trajectories from urban-based mass tourism toward rural tourism villages. In Bali, this transition intersects with persistent governance challenges, including hotel oversupply, declining occupancy rates, and increasing environmental degradation caused by land conversion, water scarcity, and uneven tourism growth. While rural tourism villages are increasingly promoted as instruments of post-pandemic recovery, their rapid expansion raises critical questions regarding sustainability, institutional coordination, and public governance capacity.

Green Tourism Villages *(Desa Wisata Hijau, DWH)* have emerged as a policy response to these challenges by integrating environmental conservation, social participation, and local economic development. In principle, DWH align with Indonesia's broader sustainable development and village empowerment agenda. In practice, however, the governance of tourism villages in Bali remains fragmented. Sustainability standards vary across villages, community participation is uneven, and

coordination among government agencies, village institutions, and private actors is limited. These governance gaps risk undermining the long-term sustainability objectives that DWH are intended to achieve.

From a public administration perspective, these challenges highlight the need for collaborative governance arrangements capable of coordinating multiple stakeholders in complex policy environments. Collaborative governance emphasizes shared decision-making, collective problem-solving, and joint responsibility among state and non-state actors, particularly where policy problems cross administrative and sectoral boundaries. In the context of tourism villages, collaborative governance commonly involves government agencies, village communities, academic institutions, private operators, and tourists—often conceptualized as the Pentahelix model. However, despite its conceptual prominence, collaborative governance in tourism village administration is frequently constrained by the absence of institutionalized tools that translate collaboration into measurable, accountable, and scalable governance practices.

Digital public administration offers a potential mechanism for operationalizing collaborative governance. Digital platforms can standardize sustainability assessments, facilitate community participation, enhance transparency, and integrate administrative and economic functions within a single governance system. Existing tourism-related digital applications in Indonesia, however, largely focus on promotion and booking services, with limited integration of governance, sustainability evaluation, and multi-stakeholder coordination. This limitation is particularly evident in rural tourism contexts, where governance capacity and data integration remain weak.

This study addresses this gap through an empirical examination of SIDeWi*HuB *(Sistem Integrasi Desa Wisata Hijau Bali)* as a digital collaborative governance instrument for tourism village administration. SIDeWi*HuB integrates sustainability assessment, village registration, and e-commerce services (DeWiKu®) into a single platform designed to support environmentally sustainable tourism governance. Rather than presenting a conceptual or review-based discussion, this article reports findings from an empirical mixed-methods study conducted across 28 tourism villages in Bali.

The study focuses on three interrelated constructs: Need for Green Village (N-GreenV), Community Participation (CP), and Perception of Sustainability (PS). N-GreenV reflects the collective community demand and readiness for adopting green tourism governance; CP captures the extent of community involvement across planning, implementation, management, and evaluation stages; and PS represents community understanding of environmental impacts and conservation responsibilities.

Within a collaborative governance framework, community participation and sustainability perception function as key causal mechanisms. Higher levels of participation strengthen trust, information exchange, and collective ownership of governance outcomes, thereby increasing community demand for formalized green tourism governance. Similarly, stronger sustainability perceptions shape normative orientations and policy preferences, encouraging communities to support governance arrangements that institutionalize environmental standards and long-term conservation goals. Accordingly, this study formulates the following testable hypotheses:

H1: Community Participation (CP) has a positive and significant effect on the Need for Green Tourism Village (N-GreenV).

H2: Perception of Sustainability (PS) has a positive and significant effect on the Need for Green Tourism Village (N-GreenV).

By testing these hypotheses using survey data collected through SIDeWi*HuB and contextualized with secondary policy and environmental data, this study contributes empirically to the literature on collaborative governance and digital public administration. It demonstrates how digital platforms can function as governance instruments rather than merely promotional tools and offers policy-relevant insights for the formulation of sustainable tourism village governance in Bali and other regions in Indonesia.

The COVID-19 pandemic transformed Indonesia's tourism landscape, accelerating a shift from urban, mass-tourism destinations toward rural-based tourism villages. In Bali, this transition aligns with the national agenda to strengthen sustainable rural tourism while responding to long-standing structural issues, including hotel oversupply, declining occupancy rates, and mounting environmental pressures. Green Tourism Villages (Desa Wisata Hijau/DWH) have emerged as a strategic alternative capable of supporting ecological preservation, social inclusion, and economic resilience during Bali's post-pandemic tourism recovery.

Current developments in sustainable tourism governance highlight the importance of collaborative governance and digital public administration as key mechanisms for integrating multi-stakeholder roles in environmental management and rural tourism development. Advances in digital platforms for tourism have mostly focused on commercial functions, while applications that combine sustainability assessment, village governance, and coordinated stakeholder participation remain limited—particularly in rural Indonesia. This gap forms the scientific foundation for proposing the DWH governance model supported by SIDeWi*HuB and its integrated application, DeWiKu®, as innovative instruments for sustainable rural tourism management.

The scientific novelty of this study lies in introducing a digitally enabled collaborative governance model for Green Tourism Villages, operationalized through a single platform that simultaneously (1) measures sustainability readiness (N-GreenV, participation, and sustainability perception), (2) standardizes village assessment, and (3) integrates e-administration with e-commerce for homestays and green attractions. This model provides an evidence-based mechanism for certifying, governing, and marketing DWH through coordinated multi-stakeholder interaction.

The research problem addressed is the lack of integrated governance mechanisms for Bali's tourism villages, which has contributed to unmanaged rural tourism expansion, environmental degradation, and fragmented institutional coordination. The study hypothesizes that higher levels of community participation and sustainability perception significantly predict community needs for green tourism villages, validating the operational feasibility of the proposed digital governance system.

The study explores collaborative governance to facilitate the sustainable development of Green Tourism Villages (DWH) in Bali through digital platforms called SIDeWi*HuB (Sistem Integrasi Desa Wisata Hijau Bali) and DeWiKu® (Desa Wisata hijauKu) for its e-commerce apps. This approach integrates environmental, social, and economic aspects to enhance rural tourism while preserving Bali's natural resources. DWH have gained significant attention due to the shift in tourism trends post-COVID-19. As highlighted in the 2020-2024 National Medium Term Development Plan on village development, DWH are emerging as a key component of rural tourism, aiming to make it a new normal. DWH represents a new generation of tourism villages that integrate the concept of a green economy, focusing on enhancing community welfare

and social justice by mitigating economic risks and conserving resources. This approach ensures the sustainability of DWH by offering tourist attractions that not only do not harm the environment but also contribute to its improvement (Simanungkalit et al., 2015).

The issue is particularly relevant in Bali, where a paradox in tourism existed even before the pandemic. Although Bali has been a favored destination for both domestic and international tourists, this popularity was not reflected in hotel room occupancy rates. By September 2019, the hospitality sector faced an excess of available hotel rooms, reaching 146,000, prompting the Provincial Government to impose a moratorium on new hotel construction across the island. This authority, although provincial, could also extend to district or city levels. At that time, the number of tourists reached 550,000 per month, four times the number of available hotel rooms. According to the Bali Central Statistics Agency (BPS Bali), the number of foreign tourists visiting the island increased by 243.59% from 2010 to 2019. The paradox arises from the fact that even without the pandemic, the growing number of foreign tourists would still face empty hotel rooms, as hotel occupancy rates had been declining since 2017, dropping to just 59.29% in January 2020.

Sandi (2024) noted that although COVID-19 has ended and tourism in Bali is starting to recover, Colliers report of Q4-2023 indicated that only 817 new rooms were added between 2020 and 2023, while 1,591 rooms were lost due to hotel closures. However, according to Airbnb, Bali ranks as the second most promising market for villas and homestays globally (Nilsen, 2018). This insight has led researchers to focus on rural homestays as a problem solving to the oversupply issue of hotel room, considering them within the broader, strategic, and integrated framework of tourism village management. This shift suggests that foreign tourists are gravitating towards rural areas and tourism villages rather than urban settings. These tourists seek more authentic experiences and benefit from lower costs by staying in local homes converted into homestays.

The advantageous features of tourism villages during the new normal align with Bali's shift in tourism focus towards rural areas through the development of these villages. However, this new potential also poses an increased risk of environmental degradation, which could affect the entire island. Currently, there are 238 tourism villages out of 716 in Bali, according to Tourism Village Communication Forum of Bali.

The risk of environmental damage is becoming more serious due to the growing number of foreign tourists in the island who opt not to stay in hotels. This rise in tourist numbers does not correlate with increased spending, as many choose more affordable accommodations such as boarding houses or homestays, often located in rural areas, over expensive star-rated hotels. In response, Badung Regency implemented Regent Regulation 35/2019, which prohibits tourists from staying in boarding houses and imposes taxes on them. Converting local homes in tourism villages into tourist cottages can mitigate environmental damage by preventing the conversion of green spaces into hotels or other new accommodation structures.

Environmental damage from the development of the tourism industry, which is central to Bali's economy, aligns with the findings of the IDEP Selaras Alam Bali Foundation. Their research highlights a clean water crisis affecting the entire island. Key issues identified include: (1) seawater intrusion into the soil due to excessive groundwater extraction, (2) groundwater pollution, (3) increasing conversion of green land, (4) improper utilization of surface water sources, leading to water being wasted into the sea, and (5) inadequate water supply during the rainy season (Dhae, 2019).

Therefore, the development of tourism villages must prioritize environmental sustainability to mitigate these threats, adopting DWH concept to ensure environmental-friendly growth. This concern has led researchers to study the development of green tourism villages, concerning on the community's need for such villages (Halim, 2022; Halim, ,2023).

This research also aims to evaluate whether this digital platform can function as an e-administration system for managing tourism villages while testing the theory of N-GreenV (Need of Green Village) as a new model. The model emphasizes "stakeholder rights" in accessing efficient public services as Information & Communication Technology (ICT) modernizes public organizations by speeding up and streamlining administrative processes as the government has implemented measures to make public information easily accessible online and has begun collecting data for future reference, aiding in monitoring tax and regional revenue, and serving as a tool for rural economic development through e-commerce.

The research seeks to propose the efficacy of DWH model through multi-stakeholder governance, and as a mean in developing public policy tool concerning green tourism villages, including their marketing. The goal is for this e-administration system to effectively map DWH and contribute to enhancing the economic well-being of rural inhabitants in the Island of Bali. This study objective is to introduce a novel approach that can potentially be implemented in other provinces across the country of Indonesia as well.

This study addresses the urgent need for sustainable rural tourism in Bali by promoting environmentally friendly homestays and green attractions through a collaborative digital system. It is significant for policymakers, as it proposes a collaborative governance model that ensures rural economic growth while mitigating environmental degradation.

Researcher have conducted preliminary studies on 9 DWH representing 9 districts/city in Bali, namely: Badung, Gianyar, Tabanan, Bangli, Karangasem, Buleleng, Klungkung, Jembrana, and Denpasar City. Several issues were identified: (1) There is a lack of clarity and standardization in the DWH system and measurement criteria. (2) There is inadequate coordination and integration of DWH across Bali, engaging the Tourism Office of Bali province as well as relevant stakeholders. (3) There is a lack of an integrated information system connecting DWH with tourist cottages and the potential packages of green tourist attractions they offer. This study objective is to overcome these issues by evaluating the efficacy of the DeWiKu digital platform. Developed through collaborative governance, this platform is designed by researchers to enhance the sustainable management of tourism villages. It is anticipated that DeWiKu will boost the visit of the tourist to villages, enhance the village businesses, and foster economic improvement among stakeholders while ensuring environmental sustainability.

The study draws upon literature in 1) Collaborative Governance, a process to unite diverse stakeholders for achieving government objectives and is integral for its efficiency in engaging multiple stakeholders (Gash & Ansell, 2007), 2) Digital Public Administration: enables efficient management through digitized information flow, enhancing stakeholder engagement and satisfaction ((Halim, 2022; Halim, 2023), and 3) Sustainability in Tourismemphasize balancing ecological, social, and economic goals. These concepts provide the basis for sustainable tourism and green village criteria applied in Bali’s tourism villages (Swarbrooke, 1999; Weaver, 2007)

Collaborative Governance brings together diverse parties to cooperate toward achieving governmental goals. They argue that the initiation of government collaboration should come from the government itself, which owns the objectives and oversees the collaborative process. The collaboration facilitates achieving governmental goals in several ways: enhancing effectiveness and efficiency, mitigating conflicts among parties, and fostering social and economic advancement. Collaboration governance involves not only combining human and other resources but also integrating knowledge and experience. This approach allows the government to harness insights and expertise from diverse parties, contributing to the achievement of governmental objectives. It extends beyond governing its own activities to regulating the actions of other entities.

Collaborative Governance is also often understood as Multi Stakeholder Partnership (MSP) approach, involving various societal stakeholders in the process of public decision-making, that may include both governmental and non-governmental organizations, civil societies, or local communities as for engaging diverse stakeholders aims to guarantee that policies are comprehensive, open, and efficient. Some studies emphasize the necessity of employing a multi-stakeholder partnership model in developing tourism based on social capital (Momen, 2020). MSP posits that addressing complex issues requires collective action from multiple stakeholders and represents a contemporary policy trend in governance, significantly influencing decision-making and policy implementation. The legitimacy of MSP hinges on the expectation of improved policy outcomes through collaborative practices that engage stakeholders in dialogue, decision-making, and policy implementation. Therefore, MSP is pertinent in shaping public policy and contributes to enhanced policy effectiveness. In the digital age, this theory's relevance continues to grow (Malcolm, 2008), as MSP fosters broader stakeholder participation, facilitates diverse perspectives, and enhances policy development. Various pertinent theories of MSP applicable in contemporary public policy, where governance bodies adapt to the digital age language, appear in many names and slightly differences but with the same spirit, such as: 1) Network Governance (Jóhannesson, 2015), 2) Participatory Governance (Quick & Bryson, 2016), 3) Co-Creation (Wellstead et al., 2022), 4) Open Governance (Meijer et al., 2019), and 5) Policy Ecology that advocates for policy that are environmentally friendly and align with the interests and needs of actors involved (Ludwig et al., 2001). All these theories share a common emphasis on the significance of stakeholder participation and dialogue in multi-stakeholder public policy decision-making to achieve effective and equitable outcomes. Many various theories can be integrated depending on the context and specific public policy goals but this study is particularly focused on exploring Network Governance, Participatory Governance, and Policy Ecology, as they relate to environmental issues within DWH and involve Pentahelix as central to the research.

Several countries have adopted the Collaborative Governance model in diverse public policies, such as Australia (O'Flynn et al., 2008) Canada (McIsaac et al., 2020), Mexico (Michel, 2017), and others. In Indonesia, (Zuhdi, 2022) explores the discrepancy between formulation and implementation of policy through cases which employ an Open Governance Co-Creation process. Several models of collaborative governance serve as references in various contexts. For instance, in the realm of Tourism Governance, (Sentanu et al., 2023) systematically discuss these models through a literature review, examining obstacles encountered across local, regional, and national contexts in multiple countries. Their study analyzes 29 relevant articles published from 2010 to 2021 to outline research trends. Additionally, (Bachtiar et al., 2022) explored the

administration approach of the Rammang-Rammang place of attraction in Maros Regency, South Sulawesi(Fitriana et al., 2023) implemented this approach to harness tourism potential as an economic recovery strategy post-COVID-19 in Sriharjo Tourism Village, Imogiri District, Bantul Regency, Yogyakarta. (Pambudi et al., 2020) described cooperation in developing a tourism villages based on ecotourism in Kalipucang Village, Pasuruan Regency, East Java. (Mafaza & Setyowati, 2020)analyzed tourism village development in Borobudur district, Magelang, facilitated by the local government through the Economic Center Village (Balkondes/Balai Ekonomi Desa) program under the Ministry of State-Owned Enterprises. (Kirana & Artisa, 2020) explored tourism villages development using Collaborative Governance in Batu City, Malang, East Java, emphasizing a paradigm shift where local government is not the sole actor in tourism village development. Additionally, (Molla et al., 2021) discussed the tourism village authority of Praijing in Tebara Village, West Sumba, while (Ariesmansyah et al., 2023) elaborated on Patengan Tourism Village in Rancabali, Bandung Regency. Many other studies focus on stakeholder coordination to enhance institutional development in tourism villages across Indonesia, such as Kanie Village in Sidenreng-Rappang Regency (Aulia, 2021), Batu City in Malang Regency (Kirana & Artisa, 2020), and Sendangadi, Sleman Regency (Arifin & Utami, 2018), among hundreds studies.

Government collaboration has also been extensively utilized in other contexts throughout Indonesia. For instance, it has been employed in addressing child stunting in Aceh (Lestari, 2022), managing public complaints related to traffic in (Gunawan & Ma`ruf, 2020), fostering MSMEs (Micro, Small, Medium Enterprises) development in Banda Aceh (Wardana et al., 2023), enhancing educational innovation and creativity through collaboration between universities, industry, and government in higher education (Diana & Hakim, 2020), implementing education strategies during the COVID-19 pandemic in West Kalimantan (Rupita et al., 2021), managing COVID-19 responses in Poso (Akib et al., 2023), and improving public services at Barru Regency port (Fatman et al., 2023) These studies underscore the diverse applications of collaboration across sectors and regions in Indonesia.

Gaps addressed by the study while there are extensive research on collaborative governance in tourism but it is limited exploration into the use of digital platforms for environmentally sustainable tourism in rural Bali. This study fills this gap by testing a digital governance model that aligns with local regulatory standards and environmental sustainability goals. Therefore, the research problem can be stated that there has been environmental degradation due to increased tourism in Bali's rural areas, alongside a lack of integrated management for green tourism villages. The objectives of the research is to develop and to assess a collaborative digital platform (SIDeWi*HuB) that enhances the management, promotion, and sustainability of green tourism villages in Bali, while the context is Green Tourism Villages in post-COVID-19 era regarding rural tourism expansion that focused on 28 selected tourism villages in Bali

Methods

This study employed a convergent mixed-methods design, in which quantitative and qualitative–secondary data were collected and analyzed in parallel and subsequently integrated at the interpretation stage. This design was selected to enable simultaneous examination of measurable relationships among governance-related variables at the community level and contextual policy, environmental, and institutional dynamics influencing Green Tourism Village (Desa Wisata Hijau/DWH) governance in Bali.

In this convergent design, quantitative survey data constituted the core empirical component used to test hypotheses regarding the relationship between community participation, sustainability perception, and community demand for green tourism governance. Qualitative–secondary data were used to contextualize, corroborate, and explain the quantitative findings by situating village-level results within broader policy frameworks, tourism trends, and environmental conditions beyond the survey context.

The study utilized a mixed-methods approach, incorporating both primary and secondary data for analysis and assessment. Primary data was collected through a survey with 126 respondents from 28 green tourism villages in Bali. Respondents included village officials, tourism village operators, village organisations, and the locals. The survey used the SIDeWi*HuB platform to assess both the demand and readiness of villages for sustainable tourism using an assessment that aimed to gauge the community's need of green village.

Data Sources and Collection

Primary quantitative data were collected through a structured survey administered via *the* SIDeWi*HuB* digital platform, involving 126 respondents from 28 tourism villages across nine regencies/city in Bali; respondents represented key village-level stakeholders—village officials, tourism village managers, village organization members, homestay operators, attraction operators, and local residents—reflecting the collaborative governance context in which DWH operate, and the instrument measured three principal constructs: (1) Need for Green Village (N-GreenV), capturing community demand and readiness for green tourism governance; (2) Community Participation (CP), assessing involvement across planning, implementation, management, and evaluation stages; and (3) Perception of Sustainability (PS), measuring understanding of environmental burdens and conservation responsibilities, with all items embedded in SIDeWi*HuB* to ensure standardized administration and data integrity; concurrently, secondary data were collected as qualitative contextual materials, including national and provincial tourism policy documents (including post-COVID tourism recovery strategies), official tourism statistics (hotel occupancy, tourism village distribution, rural tourism trends), environmental reports (land conversion, water scarcity, ecological pressures in Bali), and prior empirical studies and baseline assessments conducted by the researchers, which were used to provide institutional, environmental, and policy-level perspectives not directly observable through village-level surveys.

Analytical Procedures

Quantitative data were analyzed in SPSS version 25 using descriptive statistics, reliability testing to support scale consistency and validity, Pearson correlation to examine relationships among N GreenV, CP, and PS, and multiple linear regression with diagnostic checks to test whether CP and PS predict N GreenV. Qualitative secondary documents were analyzed through thematic content analysis to identify key themes on governance, environmental risks, digital governance reforms, and policy narratives, and these themes were used to interpret the quantitative patterns. Integration occurred at the discussion stage by using qualitative insights to contextualize, validate, and strengthen the policy relevance of the quantitative results.

Operational Definition

As for this study aims to propose an integrated digital platform as a post-pandemic solution for Bali tourism, it will encompass stages from assessment to marketing, addressing the challenge of rising tourist numbers in Bali while mitigating environmental impacts caused by the mismatch between tourist influx and available hotel rooms. The extensive development has diminished green spaces and altered natural environments. Thus, it is also a pressing demand for green tourism practices that shift from mass tourism in the city to promoting quality tourism in the villages, from urban areas to rural settings. To meet the research goals, a comprehensive coordination framework was established to select the sample DWH. Inadequate management of tourism villages can foster unhealthy competition among them, given that these villages are overseen by diverse entities such as the tourism awareness community *(kelompok sadar wisata/pokdarwis),* the village-owned enterprise *(Badan Usaha Milik Desa/BUMDes)*, cooperative, and others.

From a marketing standpoint, ensuring the environmental integrity of marketed tourism villages requires e-commerce or a digital marketing platform. Hence, the DeWiKu digital application was created to ensure that environmentally sustainable tourism villages are prepared for business. The platform offers additional functionalities such as online booking and payment, enabling tourists to book and pay directly through the application. Additionally, training sessions will be provided to operators in selected tourism villages to improve their proficiency in using the platform.

Variable

Based on the research focus and the data gathered using the N-GreenV assessment created by the researcher (Halim, 2022), this study aims to achieve two main outcomes: 1) mapping of Green Tourism Villages (DWH), and 2) analysis of stakeholders in tourism villages across three measured variables. These variables include Need for Green Village/N-GreenV, 2) Sustainability perceptions, and 3) Community engagement. These variables have also been applied by researchers to compare urban and rural tourism villages in Bali (Halim & Ervina, 2021), as explained below:

1) Need of Green Village (N-GreenV), The concept of sustainability was initially introduced by (Spreckley, 1987) in his book titled Social Audit, followed by (Elkington, 1998) who use the terminology of 3Ps (Planet, People, Profit) based on the report of Brundtland Commission at the 1987 UNWCED or United Nations World Commission on Environment & Development to define sustainable development. (Swarbrooke, 1999) subsequently applied this framework to Sustainable Tourism, refining the 3P model to focus on: 1) Environmental Conservation, 2) Social Justice, and 3) Economic Efficiency within the tourism industry. (Weaver, 2007) proposed an alternative approach with the model of Strong Sustainable Tourism, that critiques the 3P by prioritizing Environmental concerns over social issues, and social concerns over Economic factors. This study evaluates the theories of Weaver and Swarbrooke and applies them to map the distribution of DWH in Bali.
2) Perception of Sustainability (PS), This variable assesses individuals' comprehension of sustainability principles. According to (Sudarto, 1999), tourism involves conducting responsible tourism activities that uphold environmental principles, such as those practiced in DWH. Sudarto's study examined community perceptions regarding the function of tourism in green economic development, environmental

conservation, and community empowerment. It proposed two indicators to gauge perception, which are: 1) environmental burden, and 2) conservation efforts.

3) Community Participation (CP), Priasukmana & Mulyadin (2001) introduced a participatory model consisting of four stages for the development of tourism village aligned to the implementation of Regional Autonomy Law. These stages include: 1) Planning, 2) Implementation, 3) Management, and 4) Evaluation, aimed at overseeing the sustainable development initiatives undertaken.

Collaborative Actors

This research is grounded in the Pentahelix collaborative governance model involving five stakeholders. The implementation of SIDeWi*HuB, illustrated in Figure 1, engages these stakeholders: the Regional Government (represented by the Tourism Office), Higher Education and Academic Institutions (including Bali International Polytechnic, AMIKOM University, Telkom University, and Bali State Polytechnic), Operator (PT. RIZQ Sanjaya Teknologi), Communities in Tourism Villages, and Tourists.

The Bali Provincial Tourism Office, in its regulatory capacity, oversees DWH governance and ensures that registered tourism villages adhere to environmental principles. Higher education institutions play a critical role in implementing and monitoring standards by conducting rigorous assessments of DWH and supporting them through collaboration with the Bali Province Tourism Village Communication Forum, an NGO focused on the development of tourism villages to meet DWH criteria.

In Bali there are two types of villages with their respective leadership; Formal villages headed by perbekel, and traditional villages headed by bendesa. Formal villages have a direct structure to the Provinsial Tourism Office, while Traditional villages, although they are also under the coordination of the Tourism Office, have their own autonomy. Therefore, the role of Tourism Village Communication Forum is very vital because it is able to unite these two types of villages.

PT RISQ would benefit from the platform by potentially expanding its use to other provinces or integrating it into its corporate social responsibility initiatives. Local communities in tourism villages, who are the primary beneficiaries, can utilize the DeWiKu app to market their tourism offerings and enhance their economic well-being, under the condition that they provide data for verification by the Tourism Office. Simultaneously, tourists can efficiently make online bookings to experience high-quality tourism experiences.

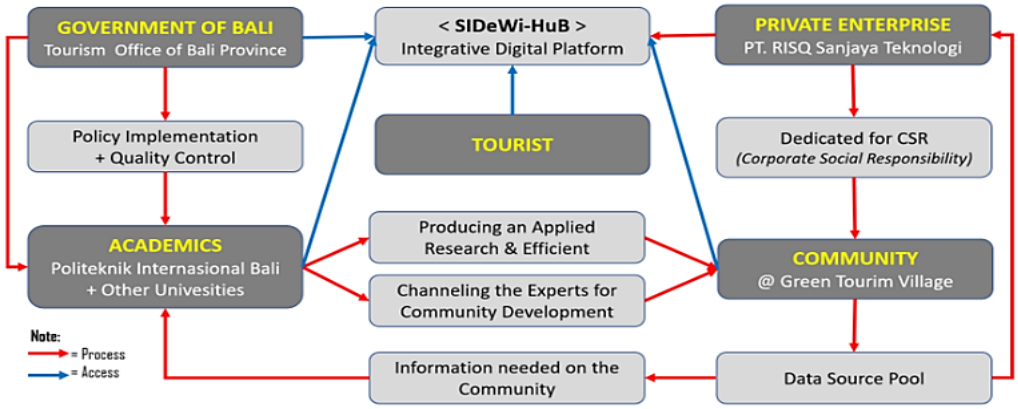

Figure 1. SIDeWi*HuB's pentahelix collaborative governance model
Source: processed by author

Procedure

Figure 2 illustrates the process of the platform of SIDeWi*HuB integrated within DeWiKu app, accessible at www.dewiku.co.id or downloadable via Playstore (Android) or Appstore (iOS). The process flow is structured into three stages as outlined below:

1) Online assessment, This stage serves to assess tourism villages for compliance with DWH standards. If a village does not meet the criteria, Tourism Village Communication Forum Dewi Bali with recommendations from the Bali Tourism Office will facilitate the village until it fulfills DWH requirements.
2) Registration phase, Once a touristm village meets criteria, it proceeds to gather product data (such as homestays and green attractions) for online publication.
3) Online Marketing, Commercial process, where at this public stage, tourists can arrange reservations thru DeWiKu that are coordinated and tracked by operators, tourism village representatives, and the Bali Tourism Office.

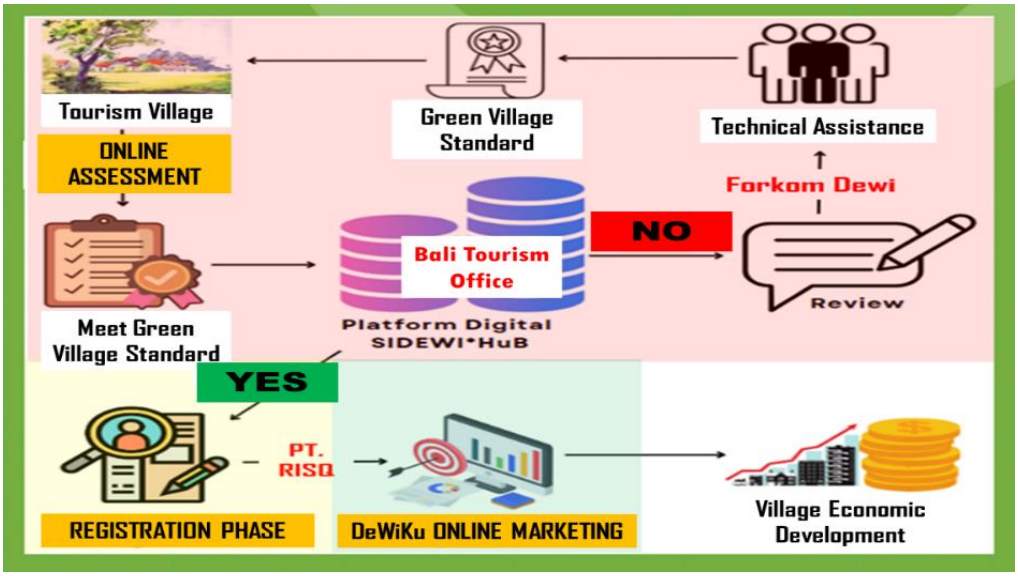

Figure 2. SIDeWi*HuB process flow
Source: processed by author

To establish minimum standards for assessing the measured DWH, this study utilized baseline data derived from initial research conducted by researchers in nine tourism villages across nine districts/cities in Bali as part of a tourism planning dissertation at Udayana University (Halim, 2022). These villages include: 1) Bongan Village in Tabanan Regency, 2) Catur Village in Bangli Regency, 3) Kerta Village in Gianyar Regency, 4) Bongkasa Village in Badung Regency, 5) Paksebali Village in Klungkung Regency, 6) Blimbingsari Village in Jembrana Regency, 7) Sudaji Village in Buleleng Regency, 8) Tenganan Village in Karangasem Regency, and 9) Sanur Kauh Village in Denpasar City.

To evaluate the degree of sustainability in tourism villages, a baseline reference is derived from the average values of each measured variable across the 9 tourism villages. This serves as the minimum normative standard for assessing whether a tourism village can be considered environmentally friendly. Unique metrics for each parameter will be established and are detailed in Table 1.

The table outlines the criteria for classifying a tourism village as green. A tourism village qualifies if it meets the following minimum criteria (standard) for respective factors: N-GreenV with a minimum score of 81, Community Participation (CP)

with a minimum score of 60, and Perception of Sustainability (PS) with a minimum score of 30. The scores resulted can be categorized DWH into three levels: Kalpataru 3 (green), Kalpataru 4 (greener), and Kalpataru 5 (greenest), providing a reference for DWH ranking.

Table 1. DWH standard value reference.

Variable	Indicator	Total Item	Max. Score	Min. Score	Theoretical Standard Score	9 Tourism Villages	
						Normative Standard Score	Lowest Standard Score
N-GreenV	Economy	9	9	45	27	37,080	35,667
	Social	6	6	30	18	24,890	23,778
	Environment	12	12	60	36	48,788	46,940
	Total	**27**	**27**	**135**	**81**	**110,758**	**106,385**
Community Participation (CP)	Planning	5	5	25	15	17,678	11,867
	Managing	5	5	25	15	18,210	13,033
	Implementing	5	5	25	15	17,740	14,409
	Monitoring	5	5	25	15	16,603	9,546
	Total	**20**	**20**	**100**	**60**	**70,231**	**48,855**
Perception of Sustainability (PS)	Environmental Load	5	5	25	15	17,625	15,960
	Conservation Effort	5	5	25	15	19,753	17,455
	Total	**10**	**10**	**50**	**30**	**37,378**	**33,415**

Source: processed by author

Population and Sample

The study population comprised 238 registered tourism villages in Bali. Using a 10 percent sampling reference and Slovin's formula with a 0.1 margin of error, a minimum sample size of 97 respondents was required. The final dataset exceeded this threshold with 126 respondents from 28 villages, ensuring adequate statistical power and representation across geographic and administrative contexts.

Figure 3. Sample Distribution across Bali Island
Source: processed by author

Results and Discussion

Results

After creating the DWH measurement tool, the researcher proceeded with a field assessment test on the selected tourism villages serving as samples. Each village was represented by its four stakeholders (village official, tourism village operators, village organisations' members, and locals). Initially, SIDeWi*HuB also screened operators of tourist cottages (homestays) and tourist attractions. Every participant in

tourism business was required to register and complete the assessment survey as part of the initial stage.

Data was gathered from six distinct stakeholder groups within each tourism village to evaluate compliance with the DWH criteria. Villages that did not meet the criteria during the field assessment phase will receive support until they achieve the required green standards. The breakdown of respondents by demographic variables such as a) position, b) age, c) education level, and d) job occupation is summarized in Table 2.

Table 2. The Characteristics of Respondents.

Demographic Variables	Description	Frequency	Percentage (%)
Stakeholder	Village Officials	19	15.08
	Tourism Village Management	26	20.63
	Village Organization	36	28.57
	Common Villagers	4	3.17
	Homestay Owners	28	22.22
	Tourist Attractions	13	10.32
	Total	126	100.00
Age	17-24 y.o.	10	7.94
	25-34 y.o.	38	30.16
	35-44 y.o.	17	13.49
	45-60 y.o.	56	44.44
	>60 y.o.	5	3.97
	Total	126	100.00
Education	Elementary School	4	3.17
	Junior High School	5	3.97
	Senior High School	52	41.27
	Bachleor/Diploma	57	45.24
	Post Graduate (S2/S3)	6	4.76
	Other	2	1.59
	Total	126	100.00
Occupation	Government Employee	7	5.56
	Private Sector	40	31.75
	Entrepreneur	33	26.19
	Housewife	9	7.14
	Farmer	11	8.73
	Craftsman	5	3.97
	Unemployment	0	0.00
	Other	21	16.67
	Total	1126	100.00

Source: processed by author

The majority of respondents come from village organizations, totaling 36 individuals (28.57%). The largest cohort falls within the 45-60 age bracket, comprising 56 individuals (44.44%), and the highest educational attainment is bachelor / diploma, with 61 individuals (45.24%). The predominant occupation among respondents is private employment, accounting for 40 individuals (31.75%). These findings suggest that the respondents generally exhibit active involvement in tourism villages, possess a relatively mature level of education, and demonstrate thoughtful engagement.

Measurements of three DWH variables - N-GreenV, Community Participation (CP), and Perception of Sustainability (PS)—across 28 tourism villages are detailed in

Table 4. The findings indicate that Lumbang Tourism Village demonstrates the highest demand for achieving green status (N-GreenV = 133.5) and exhibits significant community participation (CP = 95.5). In terms of PS, Taro Village residents display the strongest perception of sustainability compared to other villages (PS = 47.25).

Referring to Table 1 for reference standards in tourism villages, the average values obtained from 126 respondents across these 28 tourism villages exceed the established benchmarks: N-GreenV = 120.6667 > 110.758, CP = 80.1778 > 70.231, and PS = 40.4667 > 37.378. Overall, these findings categorize the 28 tourism villages in signifying green status. This score surpasses the results from the initial study involving 400 respondents across 9 tourism villages (Halim, 2022).

Table 3. Result of 3 DWH Variables

No.	Tourism Village	n	N-GreenV	Community Participation (CP)	Perception of Sustainability (PS)
1	Panglipuran	6	123.5000	92.3333	43.1667
2	Undisan	2	117.5000	82.0000	43.0000
3	Sudaji	13	118.1538	75.7692	36.4615
4	Panji	7	121.4286	87.5714	43.8571
5	Munduk	11	119.9091	74.0000	41.0000
6	Blimbingsari	1	135.0000	93.0000	44.0000
7	Perancak	2	121.5000	87.0000	45.0000
8	Medewi	4	125.7500	73.0000	38.5000
9	Bongkasa	11	121.5455	77.7273	41.3636
10	Munggu	1	117.0000	82.0000	38.0000
11	Penarungan	2	114.5000	81.0000	39.5000
12	Carangsari	1	122.0000	77.0000	37.0000
13	Sanur Kauh	6	114.8333	75.8333	36.1667
14	Serangan	1	118.0000	95.0000	49.0000
15	Penatih	3	115.6667	79.0000	38.6667
16	Paksebali	5	114.8000	79.2000	39.8000
17	Tihingan	13	120.5385	79.5385	43.4615
18	Bakas	6	111.8333	80.6667	39.0000
19	Bongan	4	123.7500	82.0000	40.2500
20	Pinge	3	124.0000	75.6667	39.3333
21	Belumbang	2	133.5000	95.5000	45.0000
22	Nyambu	3	120.0000	88.3333	43.3333
23	Tenganan	6	119.3333	71.6667	36.1667
24	Jasri	3	130.6667	89.3333	41.6667
25	Kerta	3	115.6667	78.0000	39.0000
26	Taro	4	130.5000	88.0000	47.2500
27	Sayan	1	101.0000	77.0000	34.0000
28	Mas	2	121.5000	73.0000	34.0000

Source: processed by author

The descriptive analysis of the DWH variables (N-GreenV, CP, PS) based on demographic variables (age, position/role, education, occupation) shows that respondents aged 45-60 y.o have the topmost need (N-GreenV) for the village to become a green tourism village (121.75), with the level of Community Participation (CP) of 83.93 and the Perception of Sustainability (PS) of 41.1756. In terms of position/role, village organization respondents express their wish for the village to be sustainable (125.25). Education-wise, those with postgraduate backgrounds show strong aspirations for greening their village (122.500), though the community participation (74.333) along with the perception of sustainability (39.667) remain

relatively low. Regarding job, surprisingly that housewives exhibit the highest levels of community participation (85.777) and perception of sustainability (42.888). The results of the variable testing on green village needs are presented in Table 4.

Tabel 4. Results of Demographic Variables

No.	Demographic Variables	n	N-GreenV	Community Participation (CP)	Perception of Sustainability (PS)
A.	Shareholders				
1	Village Officials	19	121.5263	80.0000	40.9474
2	Tourism Village Mgmnt	26	121.3846	83.2308	41.0000
3	Village Organization	36	119.4444	77.3056	39.1389
4	Common Villagers	4	125.2500	76.5000	41.2500
5	Homestay Owners	28	119.4643	81.9286	40.8571
6	Tourist Attractions	13	119.6154	79.4615	41.6923
B	AGE				
1	17-24 y.o.	10	118.2000	80.7000	39.7000
2	25-34 y.o.	38	120.0263	78.1316	40.1579
3	35-44 y.o.	17	117.4706	72.2941	40.1765
4	45-60 y.o.	56	121.7500	83.8393	41.1786
5	>60 y.o.	5	121,6000	80.0000	38.4000
C	Education				
1	Elementary School	4	122.2500	88.0000	44.0000
2	Junior High School	5	112.8000	82.2000	39.8000
3	Senior High School	52	120.1154	81.1923	41.1731
4	Bachleor/Diploma	57	121.5000	79.4912	40.0351
5	Post Graduate (S2/S3)	6	122.5000	74.3333	39.6667
6	Other	2	115.0000	69.0000	34.0000
D	Occupation				
1	Government Employee	7	119.8571	74.1429	40.1429
2	Private Sector	40	119.7500	79.8500	39.3500
3	Entrepreneur	33	120.2424	82.2424	41.3636
4	Housewife	9	118.4444	85.7778	42.8889
5	Farmer	11	119.0000	80.3636	41.5455
6	Craftsman	5	119.0000	69.6000	37.0000
7	Unemployment	0	-	-	-
8	Other	21	123.7619	79.4762	40.7619

Source: Processed data, 2023

To ensure accurate measurements in designing the DWH model, a correlation analysis was conducted using SPSS version 25 to examine the relationships between the three variables (N-GreenV, CP, PS). The results indicated that the correlation between N-GreenV and Community Participation (CP) is 0.451 (p = 0.01), indicates a positive relationship significantly at 99% confidence level. It suggests that as the community's demand for a green village increases, so does their level of participation, and vice versa. Similarly, the correlation between N-GreenV and Perception of Sustainability (PS) is 0.477 (p=0.01), indicates a positive relationship significantly at 99% confidence level. This implies that a higher community demand for a green village corresponds to a better perception of sustainability, and vice versa. Furthermore, the correlation between Community Participation (CP) and Perception of Sustainability (PS) is 0.636 (p=0.01), indicates a positive relationship significantly at

99% confidence level. It means that higher levels of participation are related with better perceptions, and vice versa.

In addition to assessing relationships, this study examines the effect among variables (N-GreenV, CP, PS) through an analysis of regression to confirm their interrelationships. This testing process involved several stages, including Model Summary and Regression Coefficients, detailed in Table 5 below.

Table 5. Model Summary and Coefficients of Regression

Model Summary			
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
0.514	0.265	0.253	2.690
Predictors: (constant), Total PS, Total CP		Dependent Variable: Total N-GreenV	

Coefficients					
Model	**Unstandardized Coefficient**	**Standardized Coefficients**		**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	76.418	6		11.794	0,000
Total CP	0.235	0	0.248	2.568	0.011
Total PS	0.626	0	0.319	3.303	0.001

Source: Processed data, 2023

Based on the test results, the coefficient of correlation is determined ($R = 0.514$; $p < 0.01$), indicating that Community Participation (CP) along with Perception of Sustainability (PS) are positively and significantly correlated with the Need for Green Village (N-GreenV). The combined determination coefficient ($R^2 = 0.265$; $p < 0.01$) signifies that Community Participation (CP) together with Perception of Sustainability (PS) collectively explain 26.5% of the variance in Green Village Needs (N-GreenV).

The Linear Regression equation is $Y = 0.235\ X1 + 0.628$, indicating that both Community Participation and Perception of Sustainability able to foresee the need for green village of the community positively and significantly of their villages.

Discussion

The findings of the research demonstrate that the DWH variables, assessed using the designed instruments, serve as a reliable tool for evaluating the sustainability of tourism villages. Evaluation of 126 respondents across 28 tourism villages across Bali confirmed that all sample pool villages met the criteria for Kalpataru 5 classification, indicating high sustainability. Regression and correlation analyses further affirmed that Community Participation (CP) and Perception of Sustainability (PS) positively and significantly predict the community's need for a green village (N-GreenV). These measurement instruments for the three variables are crucial benchmarks in measuring the feasibleness of a green tourism village, guiding the evaluation of tourist homestays and attractions in a village. Meeting these standards ensures suitability for marketing (via e-commerce) through the DeWiKu apps.

This study implements Collaborative Governance among stakeholders of tourism villages, adopting the Pentahelix concept (government, community, academics, industry, and tourists) in tourism sector. Academics play a key role in designing research models with appropriate metrics, supported by governmental backing through tourism offices, funded by the Ministry of Education, Culture, Research and Technology (Kemdikbudristek) and others involvement in the development of the platform. This network arrangement aligns with insights from experts Bertelli, (2006); Carlsson (2000); Howlett & Ramesh, (2003) on the roles of

actors in policy network formation. Academic-initiated Collaborative Governance also addresses criticisms by (Gash & Ansell, 2007), emphasizing that effective Collaborative Governance should be government-initiated, involving diverse stakeholders in public policy decision-making processes. Essential to this collaboration are trustworthiness, integrity, and ethics among all involved stakeholders.

The empirical findings underscore significant contributions to the literature on collaborative governance, digital integration in tourism management, and sustainable rural development. This study addresses key gaps in the literature by focusing on a collaborative governance framework tailored to green tourism villages (DWH) in Bali, operationalized through the SIDeWi*HuB platform, as follows:

1. Filling Gaps in Collaborative Governance for Tourism
   This research expands the current understanding of collaborative governance by applying the Pentahelix model specifically to rural tourism in Indonesia, particularly in Bali, where government, community, academia, industry, and tourists are engaged in sustainable tourism practices. Previous studies often discussed stakeholder involvement in general terms; however, this study provides a structured application through digital integration and identifies the specific roles each actor plays. The research aligns with (Gash & Ansell, 2007) collaborative governance framework but extends it by incorporating a digital platform, which enhances accessibility and interactivity among stakeholders.
2. Extending Digital Public Administration for Tourism Sustainability
   While digital public administration has been widely studied, its application in tourism, especially in the context of rural villages, remains underexplored. By integrating SIDeWi*HuB and DeWiKu as digital platforms, this study demonstrates how e-administration can streamline stakeholder collaboration and village sustainability assessment. This contribution is particularly valuable in resource-limited settings, as it shows how digital tools can support environmental sustainability and rural economic development by facilitating efficient communication and data management among tourism stakeholders.
3. New Insights into Community Participation & Sustainability Perceptions
   The empirical findings reveal a positive correlation between community participation and perceptions of sustainability, reinforcing the notion that local involvement is essential to achieving sustainable tourism goals. This study provides quantifiable evidence of this relationship within the context of green tourism, adding specificity to prior generalizations on stakeholder engagement in sustainability. By empirically confirming that higher levels of community involvement enhance sustainability perceptions, the study advances Weaver's strong sustainability model, emphasizing community engagement as a key factor.
4. Policy Implications & Broader Applications
   The findings have practical implications, offering a model that can be adapted to other Indonesian provinces or similar tourism settings globally. The framework developed provides policymakers with a tested structure for integrating collaborative governance with digital platform to support sustainable tourism, creating a replicable model that meets economic and environmental needs.

The findings contribute to bridging theoretical and practical gaps in collaborative governance, digital public administration, and sustainability practices in rural tourism, with implications for policy and research in developing sustainable tourism models. This study not only addresses the need for more sustainable and

community-centered tourism but also provides a digital framework that can enhance governance efficiency across similar contexts.

The **DeWiKu** platform represents a strategic approach aimed at addressing the future of green tourism and aligns to the government's initiative to promote the development of tourism villages across Indonesia, fostering local economic growth while prioritizing environmental sustainability in accordance with sustainable principles. Collaborative Management under DWH framework should serve as strategic approach for managing tourism villages nationwide, emphasizing environmental sustainability. From a socio-cultural standpoint, tourism villages can also function as a community empowerment strategy, providing employment opportunities for rural communities. Economically, tourism villages serve as a viable strategy to enhance the welfare of rural populations.

Conclusion

This study provides empirical evidence from 126 respondents across 28 Bali tourism villages that Community Participation (CP, $\beta=0.235$, $p<0.05$) and Perception of Sustainability (PS, $\beta=0.628$, $p<0.01$) positively predict Need for Green Village (N-GreenV), explaining 26.5% of variance ($R=0.514$, $R^2=0.265$, $SEE=2.690$). All sampled villages met Kalpataru 5 (greenest) thresholds, validating SIDeWiHuB as a digital tool for collaborative Pentahelix governance in assessing and standardizing DWH sustainability. However, the model does not prove causality beyond these predictors or capture unmeasured factors like economic incentives or institutional barriers, which explain the remaining 73.5% of N-GreenV variance. However, future research should address several issues to strengthen the robustness and generalizability of the findings. The self-reported scales for N-GreenV, CP, and PS, although reliable, remain susceptible to social desirability bias and rely on researcher-developed items without external validation against objective indicators such as audits or resource-use data, while digital administration may undercapture less tech-savvy stakeholders. In addition, the Slovin-derived sample may overrepresent organized and digitally engaged actors recruited via SIDeWiHuB, thereby underrepresenting passive residents and non-tourism stakeholders and limiting transferability beyond Bali's tourism contexts. Policy-wise, SIDeWiHuB could be strengthened as a standardized DWH assessment and coordination platform through digital literacy training, incentives linked to Kalpataru scores, mandatory use for village registration, and tighter integration of DeWiKu e-commerce with verified green homestays. Finally, longitudinal and cross-province studies with broader samples and objective sustainability metrics are needed to test the durability and comparative validity of CP and PS outcomes.

From a practical and empirical standpoint, the findings underscore the central role of community preparedness in advancing village development and sustainable tourism governance. Strengthening local capacity through targeted interventions is therefore essential. Local governments and tourism agencies can implement capacity-building programs that enhance digital literacy and technical skills within rural communities, enabling more active engagement with platforms such as SIDeWiHuB and DeWiKu in managing tourism sustainably. In parallel, the introduction of incentive structures that reward environmentally responsible practices can motivate village operators and small businesses to adopt green tourism principles, particularly when financial incentives are linked to sustainability performance indicators assessed through digital systems.

In addition, the establishment of collaborative policy forums that convene stakeholders from the Pentahelix model can improve alignment between community priorities and sustainable tourism initiatives while facilitating knowledge exchange and joint problem-solving. Collectively, these measures would ensure that communities are not only better prepared but also adequately supported by institutional resources and policy frameworks. In line with the study's objective of fostering collaborative governance in administering DWH in Bali through SIDeWiHuB, the findings contribute practical insights for formulating public policies on green tourism village development and marketing. Looking ahead, the planned expansion of DeWiKu to other tourism villages in Bali, and potentially across Indonesia, positions the platform as a scalable model for collaborative public policy that places environmental sustainability at its core.

Acknowledgement

The research was funded by Ministry of Research, Science and Higher Education thru Kedaireka 2023 research grant scheme. Acknowledgement can also be dedicated to people who contribute in the study.

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