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Integrating technology and social media branding to enhance sustainable tourism development through green tourism supply chains in Banten tourism villages

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ABSTRACT

The development of sustainable rural tourism increasingly depends on digital transformation. However, limited empirical evidence explains how digital adoption and branding activities translate into sustainability outcomes through green operational mechanisms. This study examines the influence of technology adoption and social media branding on sustainable tourism performance, with Green Tourism Supply Chains (GTSC) as a mediating construct. A quantitative survey of 385 tourism stakeholders in Banten Province was analyzed using SEM-PLS. The findings show that both technology adoption and social media branding significantly affect sustainable tourism, with social media branding exerting the strongest influence. GTSC significantly mediates these relationships, confirming that sustainability gains are maximized when digital strategies are embedded within eco-efficient supply chain practices. This research contributes conceptually by integrating digitalization and green supply chain perspectives within a single model, addressing a gap in prior studies that often examined these constructs separately. Practically, the findings recommend that rural tourism managers intensify digital capability development, create green supply networks, and leverage social media strategically to enhance destination sustainability.

ABSTRAK

Pengembangan pariwisata berkelanjutan di kawasan pedesaan semakin bergantung pada transformasi digital. Namun, masih terbatas bukti empiris yang menjelaskan bagaimana adopsi digital dan aktivitas branding dapat menghasilkan capaian keberlanjutan melalui mekanisme operasional berbasis lingkungan. Penelitian ini menguji pengaruh adopsi teknologi dan branding media sosial terhadap kinerja pariwisata berkelanjutan, dengan Green Tourism Supply Chains (GTSC) sebagai variabel mediasi. Survei kuantitatif terhadap 385 pemangku kepentingan pariwisata di Provinsi Banten dianalisis menggunakan SEM-PLS. Hasil menunjukkan bahwa adopsi teknologi dan branding media sosial berpengaruh signifikan terhadap pariwisata berkelanjutan, dimana branding media sosial memiliki pengaruh paling kuat. GTSC juga memediasi hubungan tersebut secara signifikan, yang menegaskan bahwa pencapaian keberlanjutan akan optimal apabila strategi digital terintegrasi dalam praktik rantai pasok yang ramah lingkungan. Secara konseptual, penelitian ini berkontribusi dengan mengintegrasikan perspektif digitalisasi dan rantai pasok hijau dalam satu model, mengisi kesenjangan penelitian terdahulu yang umumnya menguji konstruk

tersebut secara terpisah. Secara praktis, temuan ini merekomendasikan pengelola desa wisata untuk memperkuat kapabilitas digital, membangun jaringan rantai pasok hijau, serta memanfaatkan media sosial secara strategis untuk meningkatkan keberlanjutan destinasi.

INTRODUCTION

Tourism has emerged as a pivotal driver of inclusive and sustainable economic growth, particularly within rural areas of developing nations (Bhatt et al., 2024). In Indonesia, the development of tourism villages has been strategically leveraged to empower local communities, diversify income streams, preserve cultural heritage, and protect the natural environment (Rosalina et al., 2023). This initiative is actively promoted by the Ministry of Tourism and Creative Economy as part of the national agenda for tourism recovery and (Hariyanto & Asthu, 2025).

Banten Province, endowed with rich cultural heritage, diverse agroecological landscapes, and strategic proximity to major urban centers such as Jakarta, has increasingly prioritized community-based tourism development (Indrajaya et al., 2022). However, despite these advantages, the implementation of sustainable tourism practices across Banten's tourism villages remains suboptimal. Empirical evidence indicates persistent challenges, including limited digital capabilities, inadequate market exposure, and the absence of environmentally responsible operational frameworks (Aminah et al., 2023; Santoso et al., 2021). Digital transformation efforts are further constrained by low technology adoption, insufficient human capital capacity, and inadequate infrastructure factors that hinder innovation, marketing efficiency, and service quality (Ferrari et al., 2022; Joko Haryono et al., 2025).

Technology adoption is widely recognized as a catalyst for tourism innovation, facilitating smart tourism systems, enhancing service delivery, and enabling data-driven planning (Sustacha et al., 2023). Yet, most tourism villages in Indonesia, including those in Banten, have yet to integrate essential digital tools such as e-booking systems, online marketing channels, or IoT-enabled environmental monitoring (Utami et al., 2023). This technological lag reduces operational efficiency and diminishes competitiveness, especially in the post-pandemic context where contactless services and online engagement are increasingly valued (Mior Shariffuddin et al., 2023).

Technology adoption involves the integration of novel tools to improve efficiency, foster innovation, and enhance organizational performance (Taherdoost et al., 2024). Numerous studies have underscored its role in improving operational efficiency, visitor engagement, and informed decision-making (Russo et al., 2024). However, rural tourism contexts often face structural barriers such as digital illiteracy, infrastructural limitations, and institutional inertia that inhibit technological diffusion (Madanaguli et al., 2022). Many tourism villages in Indonesia still operate under manual management systems, impeding competitiveness in the increasingly digital tourism marketplace (Muryanti, 2023).

Institutional support and human capital development are essential enablers of digital adoption. As noted by (Schönherr et al., 2023), the uptake of digital tools is more likely when supported by sustained training, reliable infrastructure, and peer learning mechanisms.

Social media branding is the strategic use of digital platforms to shape and promote a destination's identity, values, and image through consistent messaging, compelling visual storytelling, active audience engagement, and coordinated content management (Dubbelink et al., 2021). In tourism, it has become a key instrument in destination marketing (Tran & Rudolf, 2022). Effective digital storytelling can enhance visibility, foster tourist trust, and cultivate emotional connections between travelers and local culture (Li et al., 2024). Social media enables destination managers to shape narratives, promote unique values, and engage with tourists in real time (Z. Zhang et al., 2025). Research by (Mutmainah et al., 2025) revealed that social media storytelling significantly influences tourist interest and destination image, especially when content reflects authenticity and community participation

In Indonesia, social media branding has been shown to significantly influence tourist interest in village-based destinations, particularly when the content is culturally authentic and community-driven (Wilopo & Nuralam, 2025). Nevertheless, many tourism villages in Banten, such as Cikolelet and Citorek, lack structured branding strategies and consistent content production, limiting their ability to penetrate wider markets and build tourist loyalty (Budilaksono et al., 2024; Syamsul et al., 2023).

The Green Tourism Supply Chain (GTSC) concept emphasizes integrating eco-friendly practices such as sustainable sourcing, waste reduction, and energy efficiency into all stages of tourism operations to promote environmental sustainability (Ma et al., 2024). GTSC adoption strengthens local economic resilience while mitigating ecological degradation (Liu et al., 2024). However, in Indonesian tourism villages, GTSC implementation remains fragmented, hindered by limited awareness, inadequate technical capacity, and weak inter-stakeholder coordination (Dias et al., 2024; Pan et al., 2018; D. D. Zhang et al., 2025). The absence of robust regulatory frameworks and standardized certification systems further slows the institutionalization of green supply chain practices (Blind & Heß, 2023). Furthermore, institutional challenges such as limited coordination between

village tourism groups (POKDARWIS), local governments, and private actors exacerbate the problem. (Arintoko et al., 2020; Buchari et al., 2024) emphasize that the lack of entrepreneurial leadership and governance capacity undermines innovation potential in community-based tourism systems. Studies highlight that effective GTSC implementation requires integrated action among local governments, tourism actors, and supply chain partners to ensure environmental practices are applied consistently and holistically (Markatos et al., 2024; Roxas et al., 2020).

Despite this, limited empirical research has conceptualized GTSC as a mediating mechanism that transforms digital capabilities and branding strategies into measurable sustainability performance.

Accordingly, this study investigates the effects of technology adoption and social media branding on sustainable tourism in Banten's tourism villages and explicitly examines GTSC as a mediating construct. Theoretically, this study is grounded on Technological Innovation Systems (TIS) Theory which stresses the importance of knowledge diffusion, institutional support, and technology-driven capabilities and the Resource-Based View (RBV), which explains how intangible assets such as digital identity, branding capability, and governance orientation generate sustained competitive advantages. Through this theoretical lens, GTSC is positioned as the operational pathway through which innovation inputs (technology adoption and branding capability) are translated into sustainability outcomes. Thus, the causal logic assumes that digital readiness and branding strength contribute to sustainability not merely directly, but through green operational governance. This theoretical integration strengthens academic rigor and provides a coherent justification for the mediation mechanism tested in this study, offering both conceptual advancement and strategic guidance for digital–green transformation in Indonesia's tourism villages.

METHODS

This research employs a quantitative approach to explore links between technology adoption, social media branding, GTSC, and sustainable tourism, using structured questionnaires distributed to tourism village stakeholders in Banten Province. These stakeholders include community-based tourism groups (POKDARWIS), village officials, tourism entrepreneurs, and local government representatives responsible for tourism development.

Using the Lemeshow formula, a minimum sample of 385 was determined. Simple random sampling ensured equal selection, with questionnaires distributed online via Google Forms from March to May 2025.

The research instrument was adapted from validated indicators (Chiwaridzo & Masengu, 2024a) for rural sustainable tourism and utilized a 5-point Likert scale. Data analysis used SEM-PLS via SmartPLS, ideal for complex, exploratory models with moderate sample sizes (Hair et al., 2021)..

Statistical tests assessed reliability, validity, and mediation effects, enabling model validation and supporting evidence-based evaluation of structural relationships.

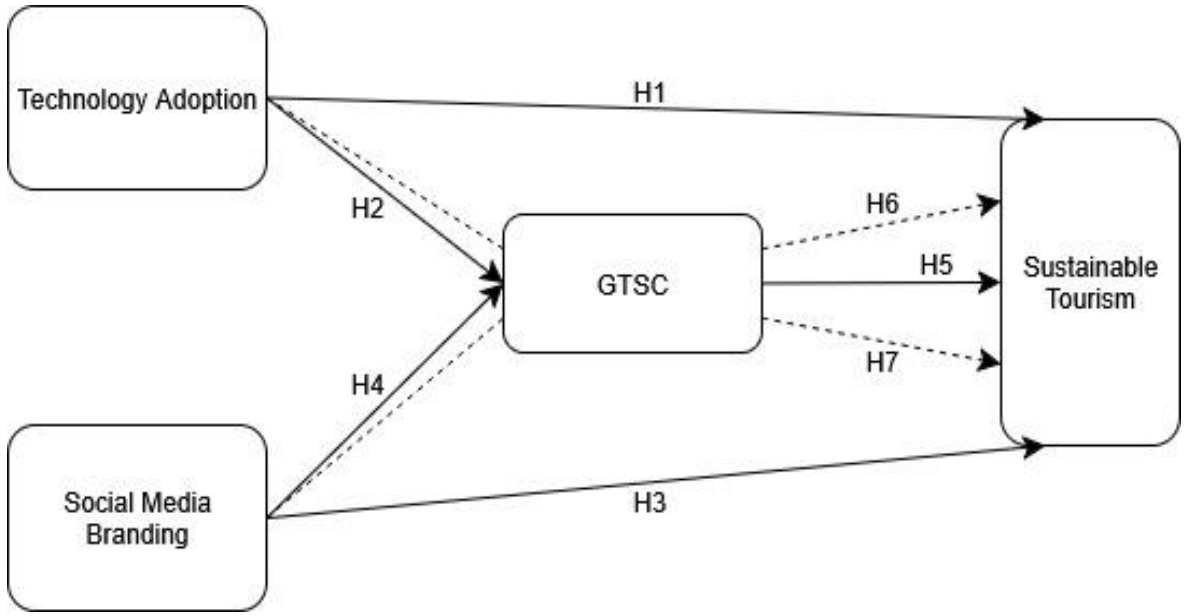

Figure 1. Conceptual Framework

Figure 1 illustrates the proposed conceptual framework, depicting the direct effects of technology adoption and social media branding on sustainable tourism, as well as their indirect effects mediated by Green Tourism Supply Chains (GTSC). Accordingly, the study proposes the following hypotheses:

H_1: Technology adoption influences Sustainable Tourism
H_2: Technology adoption influences GTSC
H_3: Social media branding influences Sustainable Tourism
H_4: Social media branding influences GTSC
H_5: GTSC influences Sustainable Tourism
H_6: Technology adoption influences Sustainable Tourism through GTSC
H_7: Social media branding influences Sustainable Tourism through GTSC

RESULTS AND DISCUSSION

As seen on table 1, the socio-demographic characteristics of respondents include gender, age group, stakeholder role, education level, tourism-related experience, familiarity with digital tools, and involvement in sustainable tourism practices. This profile offers essential contextual insight for interpreting the study's results and understanding the overall composition of the surveyed population. Table 1 reveals key insights on Banten tourism stakeholders' readiness. Most respondents are male (56.36%), with the predominant age groups being 26–35 years (31.43%) and 36–45 years (33.25%), indicating that the stakeholders are largely within productive and decision-making age brackets. In terms of stakeholder roles, the largest proportion are members of *Pokdarwis* (37.14%), followed by local tourism entrepreneurs (26.23%) and village government officials (20.52%), reflecting strong grassroots and institutional involvement.

Educationally, most respondents have at least completed senior high school, with 36.36% holding a bachelor's degree and 9.35% holding a postgraduate degree. This supports the community's capacity to understand and apply tourism innovation strategies. The tourism experience profile shows that 66.23% of respondents have over four years of involvement, demonstrating seasoned familiarity with tourism operations. Regarding digital competency, 67.54% are either familiar or very familiar with digital tools. Moreover, 52.99% are actively engaged in sustainable tourism practices.

These characteristics indicate a well-positioned respondent base for assessing the adoption of technology, branding, and green supply chain practices in tourism villages.

Table 1. Socio-Demographic Characteristics of Respondents

Profile Respondent	Category	Frequency (n)	Percentage (%)
Gender	Male	217	56.36%
	Female	168	43.64%
Age Group	18–25 years	45	11.69%
	26–35 years	121	31.43%
	36–45 years	128	33.25%
	>45 years	91	23.64%
Stakeholder Role	Member of POKDARWIS	143	37.14%
	Village Government Official	79	20.52%
	Local Tourism Entrepreneur	101	26.23%
	Regional/District Tourism Officer	32	8.31%
	Community Representative	30	7.79%
Education Level	High School	122	31.69%
	Diploma	87	22.60%
	Bachelor's Degree	140	36.36%
	Postgraduate	36	9.35%
Experience in Tourism (Years)	< 1 year	27	7.01%
	1–3 years	103	26.75%
	4–6 years	114	29.61%
	>6 years	141	36.62%
Familiarity with Digital Tools	Very Familiar	96	24.94%
	Familiar	164	42.60%
	Less Familiar	93	24.16%
	Not Familiar	32	8.31%
Involvement in Sustainable Tourism Practices	Active	204	52.99%
	Limited	138	35.84%
	Not Involved	43	11.17%

Source: Results of Data Analysis (2025)

The first stage of SEM-PLS analysis involves assessing the outer model to confirm indicator validity and reliability. Convergent validity is established through factor loadings (> 0.7) and AVE (> 0.5), while internal consistency is verified using Composite Reliability and Cronbach's Alpha, both exceeding 0.7, ensuring model accuracy.

Table 2 shows that all four latent variables exhibit high reliability, with CA values between 0.871 and 0.935 and CR above 0.90. Convergent validity is confirmed, as AVE values exceed 0.5, indicating constructs

effectively capture shared variance. Furthermore, all indicator loading factors are above the 0.70 threshold, with values ranging from 0.774 to 0.916, confirming that each item strongly correlates with its underlying latent variable. These findings confirm the indicators' validity and reliability for further structural model analysis.

Table 2. Construct Reliability and Validity

Construct/Indicator	Loading Factor	CA	CR	AVE
Technology Adoption		**0.871**	**0.906**	**0.658**
1. Utilization of online reservation systems	0.816			
2. Implementation of digital tourist guide applications	0.774			
3. Use of renewable energy sources in operations	0.820			
4. Cashless payment infrastructure	0.848			
5. Cybersecurity measures and data privacy policies	0.796			
Social Media Branding		**0.906**	**0.930**	**0.726**
1. Consistency of messaging across platforms	0.847			
2. User interaction and responsiveness	0.832			
3. Visual content quality and attractiveness	0.821			
4. Use of relevant and strategic hashtags	0.869			
5. Frequency of regular posting	0.891			
Green Tourism Supply Chain		**0.927**	**0.945**	**0.774**
1. Environmentally friendly waste management practices	0.853			
2. Use of locally sourced materials and products	0.902			
3. Collaboration with eco-certified suppliers	0.889			
4. Use of low-emission transportation methods	0.916			
5. Supply chain transparency in sustainable practices	0.836			
Sustainable Tourism		**0.935**	**0.948**	**0.721**
1. Local community participation in tourism activities	0.809			
2. Biodiversity conservation efforts	0.858			
3. Empowerment of local economy and small businesses	0.904			
4. Natural resource conservation	0.794			
5. Cultural heritage preservation	0.860			
6. Environmental education for tourists	0.869			
7. Reduction in single-use plastic consumption	0.847			

Source: Results of Data Analysis (2025)

After completing the outer model evaluation, the subsequent step is to assess the structural model, also known as the inner model. This stage focuses on analyzing the relationships among the latent variables in the proposed framework. It involves evaluating the model's explanatory power through the coefficient of determination (R-squared or R^2) and examining the overall model fit.

Table 3 shows that the Green Tourism Supply Chain construct has an R^2 value of 0.4216, indicating that 42.16% of its variance is explained by exogenous variables. Sustainable Tourism has a higher R^2 of 0.6302, meaning 63.02% of its variance is accounted for by the model.

Table 3. R-square

	R Square	R Square Adjusted
Green Tourism Supply Chain	0.4216	0.4186
Sustainable Tourism	0.6302	0.6273

Source: Results of Data Analysis (2025)

Table 4 shows an SRMR of 0.0587, indicating a good model-data fit below 0.08. The d_ULS and d_G values are relatively low, suggesting minimal discrepancy between the observed and predicted matrices. The Chi-Square value of 1126.4169 reflects overall model evaluation but should be interpreted cautiously in large samples. The Normed Fit Index (NFI) score of 0.8476 is close to the acceptable threshold of 0.90, indicating an adequate model fit.

Table 4. Model Fit

	Saturated Model	Estimated Model
SRMR	0.0587	0.0587
d_ULS	0.8716	0.8716
d_G	0.5058	0.5058
Chi-Square	1126.4169	1126.4169
NFI	0.8476	0.8476

Source: Results of Data Analysis (2025)

To evaluate the proposed hypotheses, path analysis was conducted using SEM-PLS approach. This analysis examines the strength and significance of the direct and indirect relationships between latent variables. Each hypothesis is tested based on the path coefficient (β), T-statistic, and p-value.

Table 5. Hypothesis Test Results

Hypothesis: Path Analysis	Original Sample (O)	P Values	Decision
H_1: Technology Adoption −> GTSC	0.216	0.000	Supported
H_2: Technology Adoption −> Sustainable Tourism	0.186	0.001	Supported
H_3: Social Media Branding −> GTSC	0.470	0.000	Supported
H_4: Social Media Branding −> Sustainable Tourism	0.546	0.000	Supported
H_5: GTSC −> Sustainable Tourism	0.137	0.008	Supported
Mediation Effect:			
H_6: Technology Adoption −> GTSC −> Sustainable Tourism	0.030	0.036	Supported
H_7: Social Media Branding −> GTSC −> Sustainable Tourism	0.064	0.012	Supported

Source: Results of Data Analysis (2025

The hypothesis testing results, as summarized on Table 5, indicate that all proposed relationships within the structural model are statistically significant at the 5% level ($p < 0.05$), thus supporting all seven hypotheses. The significant effect of Technology Adoption on both GTSC and Sustainable Tourism indicates that digital tools and innovations directly enhance operational efficiency, environmental performance, and sustainability outcomes in tourism villages (Chiwaridzo & Masengu, 2024b; Jokom et al., 2025; Michopoulou & Pappas, 2025). This strengthens Digital Transformation theory, which views technological adoption not merely as ICT utilization, but as systemic capability upgrading that reshapes value creation mechanisms within tourism (Bratić et al., 2025; Y. Zhang & Deng, 2024).

Similarly, the strong influence of Social Media Branding on GTSC and Sustainable Tourism implies that branding functions as a strategic digital capability that shapes perception, promotes responsible consumption, and stimulates community participation participation (Shankar et al., 2022). This aligns with the RBV logic that intangible assets such as destination identity, digital storytelling, and content legitimacy are strategic resources that enhance competitiveness when they are valuable, rare, inimitable, and non-substitutable (Escobar-Farfán et al., 2024; Ruiz-Real et al., 2020).

The direct effect of GTSC on Sustainable Tourism is also supported, reinforcing the Sustainable Supply Chain Management argument that embedding eco-friendly sourcing, waste minimization, and green logistics enhances environmental, economic, and socio-cultural outcomes (Lara-Morales & Clarke, 2024; Papallou et al., 2024). More importantly, the mediation tests show that GTSC significantly mediates both the Technology Adoption → Sustainable Tourism link and the Social Media Branding → Sustainable Tourism link, which means that the contribution of digital innovation and digital branding becomes more impactful when they are operationalized into structured green supply chain (Audretsch & Belitski, 2023; Fleith de Medeiros et al., 2022; Hartley & Knell, 2022).

Supplementary qualitative insights obtained through short confirmation interviews with POKDARWIS members and village tourism administrators also corroborate this mechanism. Informants explained that digital tools (e-booking, cashless payment, content creation) only produce sustainability impact when simultaneously accompanied by transparent sourcing, waste reduction routines, and green operational discipline. Thus, qualitative evidence triangulates the statistical model and confirms that digitization alone is insufficient; sustainability impact is maximized when digital capabilities are integrated with GTSC governance.

Taken together, these results emphasize that sustainable tourism development in rural destinations requires an integrated transformation model that combines digital readiness, strategic branding capability, and green supply chain institutionalization (Harfouche et al., 2024). The theoretical contribution of this study to international tourism literature lies in positioning GTSC as a mediating mechanism that converts digital inputs (technology and branding) into sustainability outputs. This mediation logic has not been widely tested in tourism village contexts, and therefore extends the conceptual understanding of how digital transformation interacts with sustainable supply chain governance within community-based tourism systems.

CONCLUSION

The findings empirically confirm that all hypotheses are supported. Technology adoption and social media branding each exert significant direct effects on sustainable tourism, and both effects are further strengthened through the mediating role of Green Tourism Supply Chains (GTSC). These results reinforce that digital transformation tools such as online booking systems, cashless transactions, and renewable energy solutions are not only operational enhancers, but also sustainability enablers. Likewise, social media branding is demonstrated to be more than a promotional function; it is a strategic mechanism that shapes destination identity, stimulates visitor engagement, and promotes pro-environmental behavior. The mediating effect of GTSC confirms

that sustainability is maximized when digital innovation and branding capability are translated into environmentally responsible supply chain governance.

This study is limited by its geographical focus on tourism villages in Banten, which may constrain generalizability to other Indonesian regions with different institutional, socio-cultural, and infrastructural conditions. Additionally, the cross-sectional design restricts causal inference over time, and the use of self-reported data may introduce perceptual bias.

Future studies should therefore adopt longitudinal designs to evaluate temporal causality and dynamic changes in digital and green transformation. It is also recommended that comparative, cross-provincial studies be conducted (e.g. Bali, East Java, West Nusa Tenggara) to map regional variations in institutional capacity and GTSC implementation. Further, qualitative approaches (interviews/FGDs) could enrich the interpretation of behavioral mechanisms and contextual drivers.

From a theoretical perspective, this study contributes to expanding the literature on the nexus between public finance and macroeconomic performance in developing economies. The empirical investigation of Indonesia provides additional support to the proposition that health expenditure is not merely a consumption-based budget item, but rather a productive form of government investment that strengthens the macroeconomic growth engine through human capital improvements, productivity enhancement, and long-term gains in labor capacity. This finding supports the theoretical claims proposed by endogenous growth theory, which posits that investment in human capital is a critical stimulus for sustained growth. In practical terms, this research provides relevant implications for policymakers in Indonesia, especially those involved in fiscal policy, planning, and national development strategy. Government prioritization of health expenditure should be viewed as a strategic intervention capable of delivering structural transformation, rather than as a short-term cost burden. Strengthening the allocation toward the health sector, improving spending efficiency, and ensuring better governance in the execution of public budgets will become essential instruments in driving sustainable economic performance. The study's findings offer evidence-based justification for placing health investment as a core element within Indonesia's medium-term and long-term development agenda, in line with the national priority of developing a highly productive, inclusive, and competitive human capital base.

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