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From digital tools to sustainable outcomes: Empowering human resources for ecotourism development in Indonesia

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ABSTRACT

This study examines the role of digital platforms in advancing sustainable development within the ecotourism sector, emphasizing the mediating effect of human resource empowerment. An integrated model is proposed that links digital platforms to sustainable development outcomes through ecotourism education and nature conservation, with empowerment positioned as the central mechanism. Using a quantitative design, data were collected via questionnaires from 323 respondents actively involved in the ecotourism sector in Bandung, Indonesia, and analyzed through Structural Equation Modeling (SEM) with IBM AMOS. The findings confirm that digital platforms significantly enhance human resource empowerment, which subsequently strengthens ecotourism education, nature conservation, and sustainable development. Moreover, empowerment fully mediates the relationship between digital platforms and sustainability outcomes, while education and conservation also contribute directly to sustainable development. This study offers a novel contribution by integrating perspectives from digital transformation, human resource management, and sustainable ecotourism, while advancing theoretical discussions within Digital Civics, the Capability Approach, and Social Exchange. From a practical standpoint, the results highlight that investment in digital platforms must be accompanied by capacity-building initiatives that empower local communities to acquire skills, autonomy, and agency, enabling them to leverage technology for ecotourism education and conservation.

Keywords: digital platform, human resource empowerment, ecotourism education, nature conservation, sustainable development

INTRODUCTION

In the era of digital transformation, technological platforms are increasingly shaping how communities interact, learn, and participate in sustainable development (Alojail & Khan, 2023). Digital platforms function not only as communication channels but also as tools for human resource empowerment. They create opportunities for knowledge sharing, innovation, and collaborative action (Hannola et al., 2018; Martínez-Peláez et al., 2023). Based on Digital Civics and Connectivity Theory, these platforms foster new forms of participatory governance and community engagement. They help break down traditional barriers to information and expertise (Mahoney et al., 2020). In ecotourism, digital platform integration is essential for promoting conservation awareness. It also enhances educational outreach and fosters community participation in sustainability initiatives (Altassan, 2023; Zada et al., 2025)

Indonesia, one of the world's biodiversity hotspots, faces pressing challenges in balancing economic growth, environmental conservation, and community welfare (Gunawan et al., 2022). With over 270 million people and rapidly increasing internet penetration, Indonesia presents a critical case study of how digital adoption can leapfrog traditional development hurdles (Eltomoro & Gracia, 2025). Ecotourism has emerged as a promising pathway to address this dilemma, positioning local communities not only as beneficiaries but also as active participants in sustainable practices (Palmer & Chuamuangphan, 2018). However, the effectiveness of ecotourism initiatives largely depends on human resource empowerment. Individuals and communities must be equipped with the skills, knowledge, and agency to manage natural resources responsibly and benefit equitably from tourism development (D'Souza et al., 2019; Dangi & Petrick, 2021). This concept of empowerment is rooted in Community-Based Tourism (CBT) theory and Amartya Sen's Capability Approach, which emphasize enhancing people's "capabilities" to lead the lives they value, including the ability

to participate in and benefit from economic and conservation activities (Bajmócy et al., 2022; Dolezal & Novelli, 2022).

A growing body of research confirms that empowered communities strengthen ecotourism education, promote nature conservation, and contribute to sustainable development (Bindawas, 2025). Empowerment enables communities to design conservation programs, advocate for environmental stewardship, and foster ecological values (Dushkova & Ivlieva, 2024). This resonates with Social Exchange Theory (SET), which suggests that when communities perceive tangible benefits from conservation, they are more likely to engage in pro-environmental behavior (Jahan & Kim, 2021). Consequently, the interlinkages among empowerment, education, conservation, and sustainability are well established conceptually.

Despite these insights, the novelty and originality of this study lie in its integration of digital platforms, human resource empowerment, ecotourism education, nature conservation, and sustainable development into a single empirical framework addressing a clear knowledge gap in literature. While previous studies analyze these dimensions in isolation, focusing either on technological adoption (e.g., TAM, UTAUT), conservation strategies, or educational outreach, few systematically examine their interdependent dynamics (Dwivedi et al., 2019; Knight et al., 2019). This leaves unanswered questions about how digital transformation specifically empowers human resources to drive sustainability outcomes (Martínez-Peláez et al., 2023) and how these dynamics play out in the unique socio-cultural and digital context of Indonesia, where traditional community structures (e.g., adat customs) and national policies (e.g., Making Indonesia 4.0) intersect.

To address this gap, the present study proposes an integrated model that positions human resource empowerment as the key mediating mechanism linking digital platforms to ecotourism education, nature conservation, and sustainable development. The originality of this research lies not only in combining these constructs but also in theorizing and empirically testing the specific pathways that connect them. The study contributes theoretically by integrating perspectives from digital civics, the capability approach, and social exchange theory into a unified analytical framework, offering a holistic understanding of how technological access enhances individual and collective capabilities for sustainability. Methodologically, it provides one of the first empirical tests of a full-mediation model encompassing these critical constructs, thereby advancing analysis from correlation to causation. Contextually, it offers novel insights from Indonesia, illustrating how digital platforms can be leveraged for empowerment and conservation in a developing, biodiversity-rich archipelago, with implications for similar regions worldwide.

This study aims explicitly to examine the role of digital platforms in empowering human resources, investigate how human resource empowerment mediates the relationship between digital platforms and ecotourism education, nature conservation, and sustainable development, and provide practical insights for leveraging digital technologies to enhance sustainable development outcomes in biodiversity-rich contexts like Indonesia.

Ultimately, this research aims to elucidate the strategic role of digital platforms in advancing ecotourism-based sustainable development through the mediating effect of human resource empowerment. By integrating digital innovation, ecological conservation, and community participation into a single model, the study contributes to both academic understanding and practical strategies for achieving the United Nations Sustainable Development Goals (SDGs) particularly SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), SDG 12 (Responsible Consumption and Production), and SDG 15 (Life on Land) in biodiversity-rich developing contexts.

THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

Digital Platform and Human Resource Empowerment

The rapid advancement of digital technology has significantly transformed organizational practices, particularly in the field of human resource management (Baptista et al., 2020). Digital platforms such as HRIS, e-learning portals, and performance management systems enable employees to access information and training resources in real time (Siddique et al., 2025). Unlike traditional HR processes, which are manual and hierarchical, digital platforms promote accessibility, transparency, and efficiency. They reshape how employees interact with their work environment (Siddique et al., 2025). From the perspective of empowerment theory, empowerment occurs when individuals perceive greater autonomy, competence, and meaningful participation in organizational processes (Coun et al., 2022). Digital platforms contribute to this process by enhancing employees' decision-making capacity, improving communication channels, and providing opportunities for continuous skill development (Martínez-Peláez et al., 2023). In particular, self-service HR platforms allow employees to manage their personal data, apply for training, and monitor their own performance without bureaucratic barriers, thus reinforcing their sense of control and agency.

Empirical evidence further supports this linkage. Studies indicate that the adoption of digital HR tools positively correlates with employee engagement, productivity, and empowerment, as digital systems reduce dependency on supervisors and encourage proactive behaviors (Wang et al., 2024). In this way, digital platforms are not only technological innovations but also strategic enablers of employee empowerment in modern organizations.

Human resource empowerment and ecotourism education

H1: Digital platform has a positive effect on human resource empowerment.

Human resource empowerment is a critical element in fostering knowledge-sharing, skill development, and innovative practices within organizations and communities (Naqshbandi et al., 2023). In the context of ecotourism, empowered individuals such as local guides, educators, and tourism managers play a key role in transferring environmental knowledge and cultural values to visitors

(Üzülmez et al., 2023). By having greater autonomy and access to resources, empowered employees are more motivated to develop creative educational programs that highlight the importance of ecological balance, cultural heritage, and responsible tourism practices (Hu et al., 2022).

Social learning theory (Bandura, 1969) suggests that empowered individuals can act as role models, demonstrating pro-environmental behaviors and influencing others through education and interaction. Empirical studies further highlight that when human resources are empowered, ecotourism initiatives are more likely to succeed in promoting awareness and environmental literacy among both tourists and local communities (Fang et al., 2018). Thus, empowerment does not only benefit employees internally but also contributes externally through ecotourism education.

Human resource empowerment and nature conservation

H2: Human resource empowerment has a positive effect on ecotourism education.

Nature conservation relies heavily on the active participation and commitment of individuals who manage and interact with natural environments (Cabrera & Cabrera, 2005). Empowered human resources are more likely to engage in conservation activities because they feel a sense of ownership, competence, and responsibility toward their environment (Cheng et al., 2021). When employees or community members are given the authority and skills to participate in decision-making, they are more committed to protecting biodiversity, managing natural resources sustainably, and reducing harmful environmental practices (Baker & Chapin, 2018).

Empirical evidence supports this linkage: research shows that community empowerment directly contributes to more effective conservation programs by increasing participation, accountability, and local stewardship (He et al., 2020; Petriello et al., 2025). In tourism contexts, empowered staff and communities often initiate eco-friendly practices such as waste reduction, wildlife protection, and ecosystem restoration (Suriyankietkaew et al., 2025). This demonstrates that empowerment is not only a human resource strategy but also a driver of long-term conservation outcomes.

Human resource empowerment and sustainable development

H3: Human resource empowerment has a positive effect on nature conservation.

Sustainable development emphasizes the integration of economic, social, and environmental dimensions to ensure long-term well-being for both current and future generations (Hariram et al., 2023). Human resource empowerment is central to this agenda, as it equips individuals with the skills, confidence, and autonomy needed to innovate and implement sustainability-oriented practices in organizations and communities (Saeed et al., 2018). Empowered employees are more likely to adopt green technologies, promote ethical decision-making, and contribute to socially responsible projects that align with sustainable development goals (SDGs) (Chang & Ke, 2024).

From the resource-based view (Barney, 1991), empowered human resources are strategic assets that enhance organizational capability to pursue sustainable outcomes. Studies show that organizations with empowered employees tend to achieve higher levels of environmental performance, social responsibility, and long-term economic resilience (Dekoulou et al., 2023). In the context of tourism and conservation, empowered individuals can bridge the gap between policy and practice, ensuring that sustainability principles are embedded in day-to-day operations.

Ecotourism education and sustainable development

H4: Human resource empowerment has a positive effect on sustainable development.

Ecotourism education is defined as a process of transferring knowledge, values, and practices related to environmental sustainability, cultural heritage, and responsible tourism behavior to both tourists and local communities (Huang et al., 2023a). Unlike conventional education in tourism, ecotourism education emphasizes ecological literacy and sustainable practices that foster environmental awareness and community participation.

From the perspective of environmental education theory (Stapleton, 2020), education has the power to shape attitudes, influence behavior, and promote sustainable action. In the context of ecotourism, empowered guides, educators, and managers become facilitators of learning, equipping visitors and communities with the mindset needed to support sustainability (Purnomo & Purwandari, 2025). Empirical research has shown that ecotourism education significantly enhances pro-environmental behavior, environmental responsibility, and sustainable livelihoods (Jayasekara et al., 2024). Therefore, ecotourism education not only benefits individuals through knowledge acquisition but also contributes directly to the broader agenda of sustainable development.

Nature conservation and sustainable development

H5: Ecotourism education has a positive effect on sustainable development.

Nature conservation refers to the protection, sustainable management, and restoration of biodiversity and natural ecosystems to ensure the continued provision of ecosystem services essential for human well-being (Hernández-Blanco et al., 2022). Conservation initiatives such as wildlife protection, habitat restoration, and sustainable land management are critical to balancing ecological integrity with human development (Niesenbaum, 2019).

According to the sustainability framework (Hariram et al., 2023), environmental protection is one of the three pillars of sustainable development, alongside social equity and economic growth. Empirical studies highlight that conservation efforts directly support sustainable development by maintaining ecosystem resilience, generating eco-tourism revenues, and improving community livelihoods (Uddin et al., 2021). When conservation is prioritized, it not only safeguards natural resources but also creates opportunities for long-term economic stability and social well-being.

Human resource empowerment as a mediator

H6: Nature conservation has a positive effect on sustainable development.

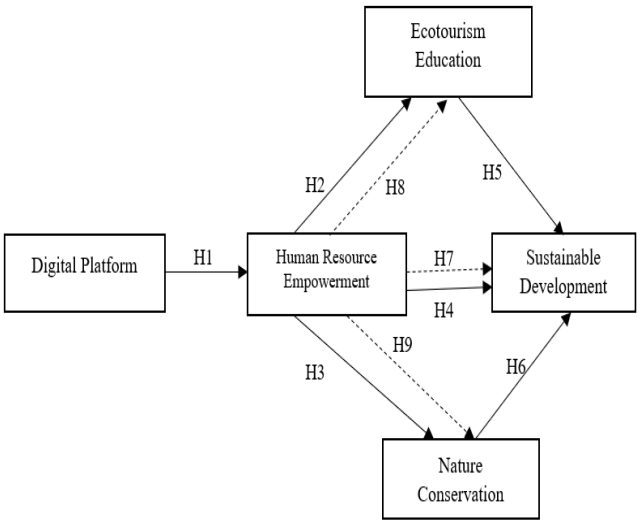

Figure 1. Research model (Source: Authors' own elaboration)

The adoption of digital platforms has reshaped organizational practices, offering real-time access to information, training, and collaborative tools (Marion & Fixson, 2021). While these platforms contribute to efficiency and transparency, their impact on broader societal outcomes requires deeper exploration (Geng, 2024). Technology alone does not guarantee sustainability; instead, human resource empowerment emerges as the key mechanism that bridges digitalization and long-term sustainability.

According to empowerment theory (Joseph, 2020) and the resource-based view (Barney, 1991), employees who are granted autonomy, competence, and meaningful participation become valuable strategic assets capable of transforming organizational resources into sustainable initiatives. Using the stimulus organism response (SOR) framework (Sultan et al., 2021), digital platforms function as the stimulus, empowerment represents the organism's response, and sustainability outcomes become the final response.

Empirical studies show that digital transformation enhances sustainability only when human resources are empowered to act as change agents (Plekhanov et al., 2023). Empowered employees are more capable of designing effective ecotourism education programs (Kunjuraman, 2022; Wiyono et al., 2023) and participating in proactive conservation practices such as biodiversity protection and waste reduction (Boiral et al., 2019; Mishra et al., 2024). These findings highlight that empowerment is not merely a by-product of digitalization but a crucial pathway to achieving sustainability-oriented outcomes.

Positioning human resource empowerment as a mediating variable provides both theoretical and practical insights. Theoretically, it explains how digital technologies generate sustainable impact through the human dimension. Practically, it emphasizes the need to empower human resources to translate digital innovation into sustainability-oriented practices.

H7: Human resource empowerment mediates the relationship between digital platform and sustainable development.

H8: Human resource empowerment mediates the relationship between digital platform and ecotourism education.

H9: Human resource empowerment mediates the relationship between digital platform and nature conservation.

Based on the proposed hypothesis, the following research model, as shown in **Figure 1**, illustrates both the direct and mediating relationships.

METHODOLOGY

Sample and Data Collection

This study employed a non-probability sampling technique combining purposive and snowball sampling. Purposive sampling was applied to select respondents who met specific criteria relevant to the research variables, while snowball sampling was utilized to reach hidden or hard-to-access populations within the Bandung ecotourism network through recommendations from initial respondents. This combination was appropriate for cross-sectional research involving hard-to-reach populations where formal sampling frames were unavailable.

Respondent criteria included:

(A) Active involvement in the Bandung ecotourism sector,

(B) Experience using digital platforms such as social media, booking applications, or websites, and

(C) Membership in one of three key stakeholder groups:

(1) Ecotourism business actors (owners or managers of eco-lodges, travel agencies, or related enterprises),

(2) Frontliners and destination managers (certified guides, operational staff, or park/village tourism managers), and

(3) Local community members (homestay owners, artisans, or Pokdarwis members).

The use of non-probability sampling was justified by the exploratory nature of the research and the limited accessibility of the population involved in ecotourism networks, where formal databases are not available. While this approach is appropriate for exploratory studies, it inherently limits the generalizability of the findings. Future studies are therefore encouraged to employ probability-based techniques to enhance external validity and enable broader generalization of results.

After a brief pre-testing process to ensure instrument clarity and relevance, data were collected over three months using online questionnaires distributed via Google Forms and professional networks. The instruments were tailored into three versions to match respondent characteristics:

1) Version (A) for business actors/managers with a strategic and managerial focus;
2) Version (B) for frontliners/operational staff emphasizing operational and educational aspects; and
3) Version (C) for local community members employing simplified language and a participatory focus.

A screening question ensured that respondents were automatically directed to the appropriate version. Out of 478 distributed questionnaires, 323 valid responses were obtained after data cleaning, resulting in a validity rate of 67.66%. This sample size was considered adequate for conducting advanced multivariate analyses such as Structural Equation Modeling (SEM).

Measurement

In this study, several research variables were measured using established scales that have been previously validated in relevant literature. The digital platform variable was measured using 8 items adapted from (Cenamor et al., 2018), with an example statement such as "The tourism platform makes it easier for me to access data and information from ecotourism partners (e.g., hotels, travel agencies, transportation, or tourist destinations)." Sustainable Development was measured using 15 items from (Biasutti & Frate, 2017), for instance, "The protection of the tourism destination environment is directly related to the quality of the tourist experience." Nature Conservation was assessed with 8 items developed by (Barbett et al., 2020), including the statement "I ensure that the destination area remains clean by regularly collecting and managing waste." Ecotourism Education was measured using 9 items from (Lee & Jan, 2018), with an example item being "My participation in ecotourism has made me more concerned about the environment." Finally, Human Resource Empowerment was measured with 5 items from (Roscoe et al., 2019), such as "I feel a shared sense of responsibility for the tourism work I carry out."

Data Analysis

Data analysis was conducted using Structural Equation Modeling (SEM) with IBM AMOS 26.0, including measurement and structural model assessments. Confirmatory Factor Analysis (CFA) was applied to test construct validity and reliability, with criteria of factor loading > 0.70, AVE > 0.50, and CR > 0.70, while discriminant validity was ensured by comparing the square root of AVE with inter-construct correlations. The structural model examined causal relationships and hypotheses, with model fit evaluated using $\chi^2/df < 3$, CFI $\geq$ 0.90, TLI $\geq$ 0.90, RMSEA $\leq$ 0.08, and SRMR < 0.08. Hypotheses were considered supported if $p < 0.05$. Mediation effects were tested using bootstrapping with 2,000 samples, where indirect effects were significant if the 95% confidence interval did not include zero; mediation was classified as full, partial, or none based on the significance of direct and indirect effects.

RESULTS AND DISCUSSION

Results

Table 1 presents the demographic characteristics of the 323 respondents, including gender, age, education, occupation, and duration of involvement in ecotourism, providing a comprehensive overview of the sample composition for this study.

Table 1 shows that the majority of the 323 respondents were female (55.73%), aged 18–25 years (34.06%), with most holding a Bachelor's degree (37.15%). Occupations were dominated by tourists (24.77%) and tour guides (20.12%), indicating that most respondents came from younger age groups with relatively high educational backgrounds and active involvement in ecotourism activities.

Table 1. Description of respondents

Demographics	Category	Total	%
Gender	Male	143	44.27%
	Female	180	55.73%
Age	18–25 years	110	34.06%
	26–35 years	96	29.72%
	36–45 years	75	23.22%
	46–60 years	42	13.00%
Education	Elementary/Junior High School	20	6.19%
	Senior High School/Vocational	95	29.41%
	Diploma (D3)	40	12.38%
	Bachelor (D4/S1)	120	37.15%
	Master's (S2)	38	11.76%
	Doctoral (S3)	10	3.10%
Occupation	Tourist	80	24.77%
	Tour Guide	65	20.12%
	Destination Manager	50	15.48%
	Local Community Member	45	13.93%
	Trader	28	8.67%
	Entrepreneur	25	7.74%
	NGO	30	9.29%
Duration of involvement	< 1 year	85	26.32%
	1–3 years	105	32.51%
	4–6 years	70	21.67%
	> 6 years	63	19.50%

The measurement model result in **Table 2** indicate that all constructs Digital Platform, Sustainable Development, Nature Conservation, Ecotourism Education, and Human Resource Empowerment meet the criteria for validity and reliability. Outer loadings range from 0.76 to 0.84, showing strong indicator contributions. Composite Reliability and Cronbach's Alpha values exceed 0.84, confirming high internal consistency, while AVE values (0.60–0.64) surpass the 0.50 threshold, demonstrating adequate convergent validity. Overall, the measurement instruments are both valid and reliable.

Furthermore, the structural model demonstrates a good level of fit, with $\chi^2/df = 2.45$ (< 3), CFI = 0.94 ($\geq$ 0.90), TLI = 0.92 ($\geq$ 0.90), RMSEA = 0.06 ($\leq$ 0.08), and SRMR = 0.045 (< 0.08). These results confirm that the proposed model adequately fits the observed data, indicating that the hypothesized relationships among constructs are statistically acceptable and conceptually robust. To ensure the absence of common method bias, Harman's single-factor test was conducted, revealing that the first factor accounted for only 31.7% of the total variance well below the 50% threshold confirming that CMB is not a concern. Additionally, data distribution was examined through Skewness and Kurtosis values, all of which fell within the acceptable range of –2 to +2, indicating that the data meet the assumption of normality and that parameter estimates are statistically reliable…

Table 3 shows that Digital Platform (DP), Human Resource Empowerment (HRE), and Ecotourism Education (EE) are positively correlated with Sustainable Development (SD), indicating that greater use of digital platforms, stronger

Table 2. Validity and reliability testing

Construct	Indicator	Outer loading	CR	Alpha	(AVE)
Digital platform	DP1	0.81	0.903	0.874	0.609
	DP2	0.83			
	DP3	0.79			
	DP4	0.80			
	DP5	0.82			
	DP6	0.77			
	DP7	0.76			
	DP8	0.81			
Sustainable development	SD1	0.79	0.918	0.895	0.635
	SD2	0.81			
	SD3	0.80			
	SD4	0.83			
	SD5	0.78			
	SD6	0.82			
	SD7	0.77			
	SD8	0.81			
	SD9	0.79			
	SD10	0.80			
	SD11	0.84			
	SD12	0.77			
	SD13	0.82			
	SD14	0.76			
	SD15	0.83			
Nature conservation	NC1	0.80	0.887	0.852	0.612
	NC2	0.82			
	NC3	0.79			
	NC4	0.78			
	NC5	0.81			
	NC6	0.77			
	NC7	0.80			
	NC8	0.83			
Ecotourism education	EE1	0.81	0.892	0.866	0.621
	EE2	0.79			
	EE3	0.82			
	EE4	0.78			
	EE5	0.80			
	EE6	0.83			
	EE7	0.77			
	EE8	0.81			
	EE9	0.79			
Human resource empowerment	HRE1	0.82	0.876	0.841	0.602
	HRE2	0.79			
	HRE3	0.81			
	HRE4	0.78			
	HRE5	0.80			

Source: Compiled by the authors

Table 3. Mean, standard deviation, and correlation

Variable	Mean	SD	√AVE	DP	DP	HRE	EE	SD.1
Digital platform (DP)	3.65	0.82	0.780	0.78	-			
Human resource empowerment (HRE)	3.78	0.79	0.77	0.42	0.42	-		
Ecotourism education (EE)	3.55	0.88	0.78	0.36	0.36	0.45	-	
Sustainable development (SD)	3.92	0.81	0.79	0.40	0.40	0.38	0.47	-
Nature conservation (NC)	3.83	0.85	0.78	0.33	0.33	0.41	0.39	0.44

Source: Compiled by the authors

human resource empowerment, and higher levels of ecotourism education are associated with improved sustainable development outcomes. In addition, Nature Conservation (NC) is positively correlated with all these variables, particularly with Sustainable Development (r = 0.44), underscoring its crucial role in supporting sustainable development efforts. These findings highlight the complementary roles of digital technology, human capacity building, ecotourism education, and nature conservation in strengthening ecotourism initiatives based on sustainable development.

Table 4. Acceptance of hypothesis

	Path	Path coefficient	*p* value	Conclusion
H1	Digital Platform has a positive effect on Human Resource Empowerment.	0.35	0.01	Support
H2	Human Resource Empowerment has a positive effect on Ecotourism Education.	0.42	0.00	Support
H3	Human Resource Empowerment has a positive effect on Nature Conservation.	0.39	0.00	Support
H4	Human Resource Empowerment has a positive effect on Sustainable Development.	0.44	0.00	Support
H5	Ecotourism Education has a positive effect on Sustainable Development.	0.4	0.01	Support
H6	Nature Conservation has a positive effect on Sustainable Development.	0.41	0.00	Support
H7	Human Resource Empowerment mediates the relationship between Digital Platform and Sustainable Development.	0.28	0.02	Support
H8	Human Resource Empowerment mediates the relationship between Digital Platform and Ecotourism Education.	0.26	0.03	Support
H9	Human Resource Empowerment mediates the relationship between Digital Platform and Nature Conservation.	0.27	0.03	Support

Source: Compiled by the authors

Based on the analysis results in **Table 4** regarding hypothesis acceptance, all proposed hypotheses in this study are supported by empirical data.

The first hypothesis (H1) indicates that Digital Platform has a positive effect on Human Resource Empowerment, with a path coefficient of 0.35 and a p-value of 0.01. This suggests that the greater the utilization of digital platforms, the stronger the empowerment of human resources in the ecotourism context. Thus, H1 is supported.

Furthermore, H2 shows that Human Resource Empowerment has a positive effect on Ecotourism Education (coefficient = 0.42, p = 0.00). This finding means that higher levels of human resource empowerment significantly enhance the quality of ecotourism education. Similarly, H3 demonstrates that Human Resource Empowerment positively influences Nature Conservation (coefficient = 0.39, p = 0.00), indicating that empowering local human resources can strengthen conservation efforts. Both hypotheses are supported.

The fourth hypothesis (H4) reveals that Human Resource Empowerment positively affects Sustainable Development, with a path coefficient of 0.44 and a p-value of 0.00. This indicates that improving human resource capacity contributes directly to the achievement of sustainable development goals. Likewise, H5 shows that Ecotourism Education positively impacts Sustainable Development (coefficient = 0.40, p = 0.01), and H6 confirms that Nature Conservation has a positive effect on Sustainable Development (coefficient = 0.41, p = 0.00). These results emphasize the essential roles of education and conservation in fostering sustainability.

Moreover, Human Resource Empowerment is found to mediate several key relationships. It mediates the effect of Digital Platform on Sustainable Development (H7; coefficient = 0.28, p = 0.02), on Ecotourism Education (H8; coefficient = 0.26, p = 0.03), and on Nature. Conservation (H9; coefficient = 0.27, p = 0.03). These findings indicate that digital platforms indirectly influence sustainability outcomes, ecotourism education, and conservation efforts through the empowerment of human resources. All three mediation hypotheses are supported.

In summary, the results highlight the central role of Human Resource Empowerment as both a direct driver of key ecotourism and sustainability outcomes and an intermediary that channels the benefits of digital platforms toward sustainable development, ecotourism education, and nature conservation.

Discussion

This study aims to investigate the mechanisms through which digital platforms influence sustainable development in the ecotourism sector in Bandung, Indonesia. The findings reveal a complex model in which the use of digital platforms significantly enhances human resource empowerment, which in turn positively impacts ecotourism education, nature conservation, and overall sustainable development (Alojail & Khan, 2023). Furthermore, human resource empowerment serves as a full mediator in the relationship between digital platforms and these outcomes, suggesting that the benefits of digital technologies are realized primarily through the capacity and competencies of empowered personnel (Martínez-Peláez et al., 2023; Zada et al., 2025). This underscores the idea that technology by itself cannot deliver sustainability outcomes unless embedded in strong human and institutional capacities (Dwivedi et al., 2019).

The role of digital platforms as drivers of human resource empowerment aligns with theoretical insights from Digital Civics and Connectivity Theory, which emphasize participation, inclusivity, and the breakdown of traditional barriers to expertise (Mahoney et al., 2020). In Bandung's tourism landscape, practitioners increasingly rely on social media, online booking systems, and digital knowledge-sharing communities to acquire skills, exchange information, and enhance operational effectiveness (Huang et al., 2023b). Digital platform act as enablers that facilitate learning, collaboration, and innovation, allowing tourism professionals to respond effectively to environmental, cultural, and market challenges (Schönherr et al., 2023). Recent studies also show that digital connectivity fosters stronger community resilience in tourism-dependent regions, making destinations more adaptive to global uncertainties (Pinto et al., 2025).

Human resource empowerment was found to have a direct influence on ecotourism education and nature conservation (Ramón-Hidalgo & Harris, 2018). Empowered personnel are more capable of designing and implementing educational initiatives that increase awareness of environmental issues among visitors and the local community (Shafieisabet & Haratifard, 2020). They also actively engage in conservation efforts that protect biodiversity and natural landscapes (D'Souza et al., 2019; Dangi & Petrick, 2021). These findings

indicate that digital platforms alone are insufficient; the transformation occurs when human resources are empowered to apply knowledge and skills effectively to ecotourism and conservation practices. Empowerment further creates long-term stewardship values, where communities internalize conservation as part of their cultural identity (Petriello et al., 2025).

Ecotourism education and nature conservation, in turn, contribute directly to sustainable development in Bandung's tourism context. Educational programs promote pro-environmental behaviors among tourists, while conservation initiatives safeguard ecological integrity and cultural heritage, generating long-term social, economic, and environmental benefits for local communities (Dushkova & Ivlieva, 2024; Elshaer et al., 2024). By mediating the effects of digital platforms, human resource empowerment ensures that digital initiatives translate into tangible sustainability outcomes. Moreover, integrating ecotourism education into local curricula has been shown to strengthen intergenerational environmental awareness, providing a foundation for sustainable futures (Jahan & Kim, 2021).

Crucially, the findings of this study hold significant relevance for national policy frameworks in Indonesia. The model of digital empowerment leading to sustainability outcomes directly supports the goals of the "Making Indonesia 4.0" roadmap, which prioritizes human capital development and technology adoption to drive economic sectors, including tourism. Furthermore, this research aligns with the Indonesian Ministry of Tourism's strategic plans for sustainable tourism, particularly its pillars on digital transformation (e-tourism) and community empowerment. By demonstrating how digital tools empower local actors to advance conservation and education, this study provides an empirical basis for policies that integrate technological investment with grassroots capacity building, ensuring national initiatives yield concrete local impacts.

Overall, this study reinforces and integrates multiple lines of research on digital transformation, human resource management, and sustainable tourism. The findings confirm that digital platforms serve as catalysts for human empowerment, which then drives educational, ecological, and developmental outcomes (Bindawas, 2025). By highlighting the mediating role of human resource empowerment, this research provides a more comprehensive understanding of how ecotourism in Bandung can leverage digital technologies to achieve sustainable development, aligning with global frameworks on responsible tourism and the Sustainable Development Goals (Bajmócy et al., 2022; Dolezal & Novelli, 2022). Importantly, situating these findings in Indonesia's socio-cultural context highlights that digital innovation must go hand-in-hand with community-based approaches rooted in local values and traditions (Dangi & Petrick, 2021).

Implications

Theoretically, this research contributes to literature by bridging the technological, social, and environmental dimensions of ecotourism into a unified framework. While previous studies have often examined digital adoption, community empowerment, or conservation in isolation, this model explicates their synergistic relationships. It extends the application of CBT Empowerment Theory and TAM by empirically validating their interconnectedness in an Indonesian context, showing that empowerment is both an outcome of technology adoption and a precursor to educational and conservation outcomes.

From a practical perspective, the findings offer a clear mandate for policymakers and destination managers. Achieving sustainable development in ecotourism destinations like Bandung requires integrated strategies that pair technological investment with robust, continuous human capital development. Simply providing digital infrastructure or enacting conservation policies is inadequate. Success hinges on ensuring that local communities possess the skills, authority, and motivation to harness technology for educational dissemination and effective natural resource management.

Based on the findings, this study offers actionable recommendations for policymakers and ecotourism managers. Policies should integrate digital and human capital development by linking infrastructure projects, like public Wi-Fi in ecotourism villages, with funded community training programs. A Green Digital Tourism Certification should be created to incentivize businesses that effectively use digital platforms for conservation and education. Additionally, policymakers should support a national digital portal for ecotourism managers to share best practices and educational materials.

For Ecotourism Managers and Business Owners:

Managers should invest in continuous digital literacy training that moves beyond basic social media to include data analytics for visitor management and digital storytelling for conservation. It is crucial to formally designate and empower staff as "Local Champions" to lead digital initiatives. Furthermore, affordable digital tools should be leveraged for active conservation, such as using smartphones for wildlife monitoring, QR codes on trails for education, and online booking systems to manage visitor capacity and reduce ecological impact.

CONCLUSIONS

This study demonstrates that digital platforms significantly enhance human resource empowerment, which in turn positively affects ecotourism education, nature conservation, and sustainable development in Bandung, Indonesia. Human resource empowerment acts as a full mediator, highlighting that technology alone cannot achieve sustainability outcomes without empowered personnel. The findings contribute theoretically by integrating digital platforms, empowerment, and sustainability into a unified framework, and practically by offering guidance for policymakers and ecotourism managers to combine digital tools with human capacity building. Future research can explore other regions or longitudinal impacts to strengthen generalizability.

Limitations and Directions for Future Research

Although this study makes a significant contribution, its findings should be viewed within several limitations that also open opportunities for further investigation. The generalizability of the model is restricted to the specific context of Bandung, a relatively developed destination, so testing it in more remote ecotourism sites across Indonesia would strengthen its external validity. The cross-sectional design and perception-based data, while robust, limit the ability to establish causal relationships and objectively measure outcomes. Therefore, longitudinal studies supplemented with qualitative data and objective metrics (such as biodiversity data or income statistics) are strongly recommended to capture process dynamics and validate the findings more comprehensively. Furthermore, the model could be enriched by incorporating other key variables that remain unexplored, such as the moderating role of government policies or local leadership, and additional mediators like social capital. Finally, in-depth research on specific types of digital platforms (e.g., comparing the impact of social media with specialized booking applications) would provide more operational guidance for practitioners. By pursuing these directions, future research can build on this study's foundation to develop a more holistic understanding of sustainable development within the ecotourism sector.

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