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**Jules NSHIMIYIMANA, UMURERWA Huguette,
GATASHYA Theobard, NDAHIMANA Osile, Dr. Francis
WANYERA (PhD) & Dr. Safari Ernest (PhD)**

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¹Jules NSHIMIYIMANA, ²UMURERWA Huguette, ³GATASHYA Theobard,
⁴NDAHIMANA Osile, ⁵Dr. Francis WANYERA (PhD) & ⁶Dr. Safari ERNEST (PhD)

^{1,2,3&4}Tourism Department, Rwanda Polytechnic – KITABI College, Rwanda

^{5&6}Faculty of Hospitality and Tourism, East Africa University, Rwanda

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Abstract

The purpose of this research was to examine how harnessing digital technologies enhances operational and service performance across Rwanda's tourism sector. The study was guided by three specific objectives: to assess the influence of digital technology adoption on service delivery among Rwanda's tourism operators and attractions; to evaluate the role of digital tourism promotion strategies in boosting tourist arrivals and satisfaction; and to analyze the relationship between digital technology harnessing and overall tourism industry performance in Rwanda. A mixed-methods descriptive research design was employed. Data were gathered via structured questionnaire and key informant interviews administered to tourism operators and tourists. The target population comprised 178 respondents drawn from tour operators, national parks, and tourism agencies in Kigali and Southern Province. Random sampling using the Yamane formula yielded a sample size of 123 respondents. Data were analyzed using SPSS version 26.0, with results presented through descriptive statistics, Pearson correlations, and multiple regression analysis. The aggregate mean for the influence of digital technology adoption on tourism service delivery was 4.558, while the mean for digital tourism promotion strategy was 4.576, both indicating strong agreement. Pearson correlation coefficients showed associations of .931** and .824** between tourism performance and digital technology harnessing and tourism promotion strategy, respectively. Regression analysis yielded R Square = .858, F = 171.634, P-value = .000b, confirming strong statistical significance. The study concluded that there is a significant positive relationship between harnessing digital technologies and performance in Rwanda's tourism industry. It is recommended that the Rwanda Development Board and Ministry of Tourism strengthen digital innovation frameworks for destination management and expand public-private partnerships to accelerate structured digital transformation across the full tourism value chain.

Keywords: Digital Technologies, Tourism Industry, Rwanda, Service Performance, Digital Promotion, Technology Adoption, Destination Competitiveness.

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1.0 Introduction

The convergence of digital technologies with the tourism industry represents one of the most profound transformations in the global service economy. From AI-powered booking engines and virtual reality (VR) destination tours, to drone-assisted wildlife monitoring and mobile-guided ecotourism experiences, the digital revolution is reshaping every dimension of how travellers discover, book, experience, and share their journeys (Buhalis & Law, 2021). The World Travel and Tourism Council (2024) estimates that the global travel and tourism sector contributed 9.1% of global GDP in 2023, with digitally enabled destinations consistently outperforming their analogue counterparts on key performance indicators such as visitor satisfaction, revenue per tourist, and destination competitiveness. In the context of sub-Saharan Africa, digital transformation in tourism has emerged as both an economic imperative and a strategic opportunity. Countries that have invested in e-tourism platforms, digital park management systems, and data-driven destination marketing have recorded measurable improvements in tourist arrivals, average spending, and repeat visitation. Kenya's eCitizen portal for national park permits, Tanzania's integration of digital ranger tracking systems in the Serengeti, and South Africa's deployment of real-time visitor analytics across its national heritage sites all illustrate the breadth and depth of digital tourism adoption across the region (UNWTO, 2023).

Rwanda presents a particularly compelling case study at this intersection. Under Vision 2050, tourism has been designated a flagship economic pillar, with the country targeting USD 800 million in annual tourism revenues by 2024 (Rwanda Development Board, 2024). The government, through the Rwanda Development Board (RDB) and the Ministry of ICT and Innovation, has made substantial investments in digital infrastructure, including nationwide 4G LTE coverage, the Smart Kigali initiative, and the Rwanda Innovation Fund, that provide a robust foundation for digital transformation across the tourism sector. In the tourism subsector, the RDB and licensed tour operators are leveraging digital platforms for destination marketing, online park booking, e-permits for gorilla and chimpanzee trekking in Volcanoes National Park, and real-time visitor analytics at Rwanda's national parks and cultural heritage sites including Nyungwe Forest National Park, Akagera National Park, and the Kigali Genocide Memorial. These developments have positioned Rwanda as a model for digitally enabled tourism in East Africa, with the country recognized by the UNWTO (2023) as one of Africa's most innovative tourism destinations.

Despite these advances, research exploring digital technology harnessing as an integrated driver of performance across the tourism sector in Rwanda remains limited. Prior studies have addressed e-tourism promotion (Gretzel et al., 2020) or digital marketing (Sigala, 2018) in isolation; however, the combined performance effects of digital technology deployment across the full tourism value chain, from pre-arrival promotion to on-site experience and post-visit loyalty, have not been comprehensively examined in the Rwandan context. This study addresses that gap by providing empirical evidence on the relationship between digital technology harnessing and tourism industry performance in Rwanda.

1.1 Research Objectives

- i. To assess the influence of digital technology adoption on service delivery among Rwanda's tourism operators and national park attractions.
- ii. To evaluate the role of digital tourism promotion strategies in boosting tourist arrivals and satisfaction in Rwanda.

- iii. To analyze the relationship between digital technology harnessing and overall tourism industry performance in Rwanda.

2.0 Literature Review

This section reviews existing literature relevant to digital technologies and performance in the tourism industry. The review is organized thematically to cover digital technologies in tourism, digital tourism promotion, tourism performance, and the theoretical foundations guiding the study. It also identifies key empirical gaps that justify the present study within the context of Rwanda's tourism sector.

2.1 Digital Technologies in the Tourism Industry

The adoption of digital technologies in the tourism industry has been extensively documented in the academic literature over the past two decades. Buhalis and Law (2021) trace the evolution of tourism technology from early computer reservation systems (CRS) through the internet booking revolution, to the current era of artificial intelligence, big data analytics, and immersive digital experiences. The authors identify three successive waves of digital transformation: the first wave characterized by computerized reservations and global distribution systems; the second wave marked by the internet and online travel agencies; and the third, current wave defined by mobile technologies, social media, AI-driven personalization, and the Internet of Things (IoT). Gretzel et al. (2020) introduced the concept of 'smart tourism' to describe destination ecosystems in which digital technologies are embedded across the entire visitor journey, from search and booking to on-site navigation, interpretation, and post-visit engagement. Smart tourism destinations leverage data generated by visitors, operators, and digital infrastructure to optimize resource allocation, enhance visitor experiences, and improve destination competitiveness. Rwanda's investment in e-permit systems, digital park management tools, and RDB's destination intelligence platforms closely aligns with this smart tourism paradigm.

Sigala (2018) examined the role of social media and user-generated content in reshaping destination marketing, arguing that digital word-of-mouth through platforms such as TripAdvisor, Instagram, and YouTube has fundamentally altered tourist decision-making. Her research found that destinations with active social media presences and influencer partnerships achieved significantly higher visitor engagement and conversion rates than those relying solely on traditional advertising. This finding is particularly relevant to Rwanda, where the RDB's social media campaigns, amplified by global partnerships including the Arsenal FC 'Visit Rwanda' sponsorship, have generated substantial international attention and measurably increased inbound tourism inquiries. Xiang and Gretzel (2019) further examined the role of search engines and online review platforms in tourist information search behavior, finding that over 80% of international tourists consult online reviews and digital destination guides before finalizing travel decisions. This underscores the strategic importance of digital destination marketing and reputation management for tourism-dependent economies such as Rwanda, where the majority of high-value tourists originate from Europe and North America and rely heavily on digital information channels.

2.2 Digital Technologies and Tourism Performance in Developing Economies

Research on digital technology adoption in developing-country tourism contexts has grown substantially in recent years, driven by recognition of the sector's transformative potential for economic development and poverty reduction. Nkosi and Hamunakwadi (2022) examined digital tourism adoption in Botswana and found that tour operators deploying digital booking and

communication systems reported 34% higher booking conversion rates and 28% lower operational costs compared to non-digital counterparts. The study also found that digital tools significantly reduced information asymmetries between operators and tourists, leading to improved visitor satisfaction scores.

In the East African context, Mwangi and Kariuki (2021) studied the impact of mobile tourism applications on visitor experience quality in Kenya's national parks, finding that parks offering mobile-guided tours and real-time wildlife tracking reported significantly higher visitor satisfaction and willingness-to-recommend scores than parks without digital offerings. These findings align closely with the present study's focus on Rwanda's national parks and ecotourism attractions, where similar mobile and drone-assisted technologies are being deployed. Osei and Gbadamosi (2020) investigated the relationship between digital marketing adoption and tourist arrivals in Ghana, finding a strong positive correlation between investment in digital destination marketing and inbound tourist growth. Their study emphasized the catalytic role of public tourism agencies in driving digital adoption across the private sector through regulatory frameworks, capacity building, and public-private digital platforms, a model that mirrors Rwanda's RDB-led approach to digital tourism transformation.

2.3 Digital Tourism Development in Rwanda: Context and Prior Research

Rwanda's digital tourism trajectory has been shaped by a unique convergence of political will, institutional capacity, and natural tourism assets. The Rwanda Development Board, established in 2008 as a one-stop center for tourism promotion and investment facilitation, has been the primary driver of digital transformation in the sector. Under successive ICT-enabled Tourism Master Plans, the RDB has deployed a suite of digital platforms spanning destination marketing, online permit management, visitor analytics, and tour operator support, creating one of East Africa's most integrated digital tourism ecosystems (RDB, 2024). Rwanda's flagship digital tourism innovation, the online gorilla and chimpanzee trekking permit system, has been widely cited as a model for nature-based tourism digitalization in Africa. Permits for gorilla trekking in Volcanoes National Park, priced at USD 1,500 per person, are now exclusively sold through the RDB's digital platform, enabling real-time inventory management, dynamic pricing experiments, and visitor data capture that inform conservation planning and marketing strategy. Prior to digitalization, permit allocation relied on manual, agency-mediated processes that limited transparency and accessibility for international visitors (Nshimiyimana et al., 2024).

Research specifically examining digital technology adoption and performance in Rwanda's tourism sector has been limited, though a growing body of work from the KITABI College of Conservation and Environment and affiliated institutions has begun to address this gap. Nshimiyimana et al. (2024) examined digital skills training and employee performance in Kigali's tourism sector, finding significant positive relationships between digital competency levels and customer service quality indicators. The present study extends this line of inquiry by examining digital technology harnessing at the sector level, encompassing both operator-side adoption and destination-level promotion strategy, and by providing the first multi-site empirical analysis spanning Kigali and Southern Province tourism operations.

2.4 Challenges and Barriers to Digital Tourism Adoption

While the benefits of digital technology adoption in tourism are well-established, the academic literature also highlights significant barriers that impede adoption, particularly in developing-

country contexts. Nkosi and Hamunakwadi (2022) identified limited digital literacy among frontline staff, inadequate ICT infrastructure in remote tourism zones, and high initial technology investment costs as the primary barriers to digital adoption among small and medium tourism enterprises in Southern Africa. These barriers are structurally similar to those reported by tour operators and park staff in Rwanda's rural tourism circuits, where connectivity gaps and skill deficits remain material constraints on the pace of digital transformation.

Gretzel et al. (2020) note that smart tourism development requires not only technology investment but also institutional coordination between government agencies, private operators, and technology providers, a form of 'digital ecosystem governance' that goes beyond individual firm-level adoption. Rwanda's RDB-centric model of digital tourism governance addresses this coordination challenge to a significant degree, but key informant interviews in this study identified coordination gaps between RDB's national digital platforms and the locally managed systems of individual tour operators and park concessionaires as an area requiring further attention. Addressing these coordination gaps through standardized data interfaces and shared digital infrastructure investments will be essential to realizing Rwanda's full digital tourism potential.

2.5 Theoretical Framework

This study is anchored in two interrelated theoretical frameworks: the Service-Dominant Logic (SDL) and the Technology Acceptance Model (TAM). These frameworks were selected because they collectively address both the supply-side dynamics of digital technology adoption among tourism operators and the demand-side dynamics of visitor acceptance and value co-creation.

2.5.1 Service-Dominant Logic (SDL)

Vargo and Lusch (2004) developed Service-Dominant Logic as a paradigm shift from goods-dominant thinking, arguing that value is co-created through dynamic interactions between providers and customers rather than embedded in discrete products or transactions. In the context of Rwanda's tourism industry, SDL provides a powerful lens through which digital technologies can be understood not merely as operational tools, but as platforms for co-creating memorable and personalized visitor experiences. When a tourist uses a mobile application to book a gorilla trekking permit, navigate Akagera National Park, review their experience in real time, or share content on social media, they are actively participating in the value co-creation process that defines modern tourism (Lusch & Vargo, 2014). SDL also highlights the importance of operant resources, knowledge, skills, and digital competencies, over operand resources such as physical infrastructure. In the Rwandan tourism context, this implies that the human capital dimension of digital transformation, the capacity of tourism operators, park rangers, and destination marketers to leverage digital tools effectively, is as important as the tools themselves. This understanding informs the study's emphasis on capacity building and digital skills development as components of a comprehensive tourism digital transformation strategy.

2.5.2 Technology Acceptance Model (TAM)

Davis (1989) introduced the Technology Acceptance Model to explain user adoption of new technologies, identifying perceived usefulness and perceived ease of use as the core determinants of technology acceptance. Subsequent extensions of TAM by Venkatesh and Davis (2000) incorporated additional antecedents including social influence, facilitating conditions, and subjective norms, producing a more comprehensive model of technology adoption behavior applicable to organizational contexts. In the tourism context, TAM is instrumental in explaining

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why tourists prefer digital booking over traditional travel agents, why tour operators invest in analytics platforms and digital destination management tools, and why park rangers adopt drone-assisted monitoring technologies. When tourism professionals find digital tools genuinely useful for improving their operational outcomes and easy enough to operate without extensive training, technology adoption accelerates and performance benefits are realized more rapidly across the sector (Venkatesh & Davis, 2000). TAM thus provides the theoretical foundation for the study's first objective, assessing the influence of digital technology adoption on tourism service delivery by linking perceived utility and usability to actual adoption behavior and performance outcomes.

2.6 Conceptual Framework

The conceptual framework developed for this study illustrates the relationship between the independent variable, the moderating variable, and the dependent variable within Rwanda's tourism sector.

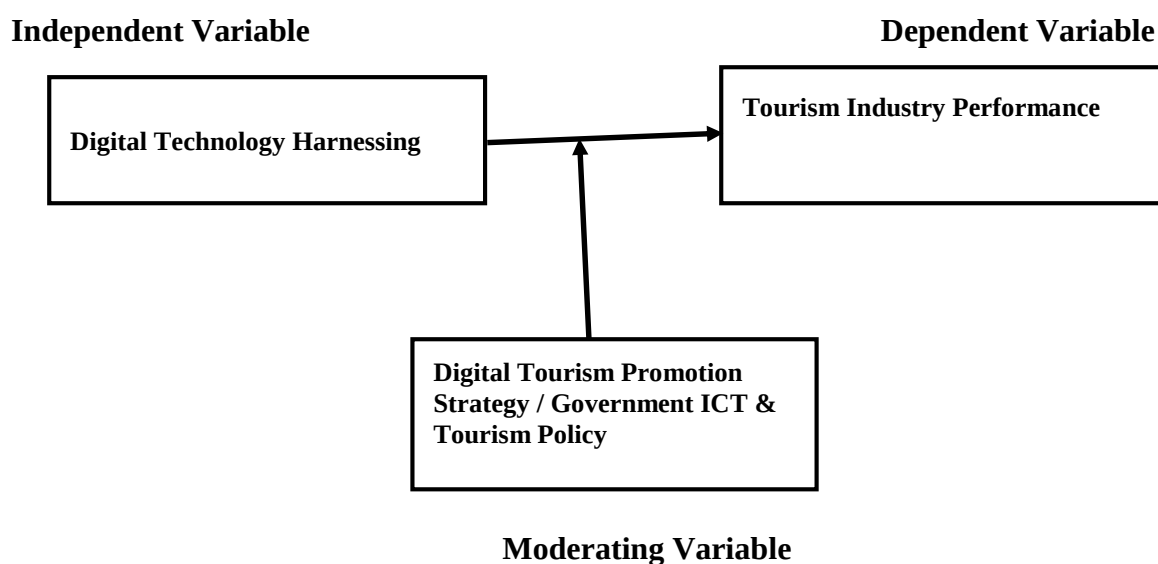


Figure 1: The Conceptual Framework

The independent variable, digital technology harnessing, encompasses the deployment of AI-powered booking engines, destination marketing platforms (DMOs), e-permit and online booking systems for tourism attractions, social media and content marketing tools, virtual reality (VR) destination previews, drone-assisted wildlife monitoring, mobile ecotourism applications, and real-time visitor analytics. These dimensions reflect the primary digital touchpoints across the destination and visitor experience dimension of the tourism industry in Rwanda. The dependent variable, tourism industry performance, is defined as the composite measure of operational efficiency, service quality, visitor satisfaction, revenue growth, and destination competitiveness achieved by Rwanda's tourism operators and national park attractions (Pine & Gilmore, 1998; UNWTO, 2023).

The moderating variable, digital tourism promotion strategy, encompasses RDB's digital marketing campaigns, e-tourism booking platforms, social media destination branding, influencer partnerships, and public-private ICT partnerships that shape the enabling environment for digital adoption and performance realization across the tourism sector (Gretzel et al., 2020). The moderating relationship reflects the theoretical position that the strength of the link between digital

technology harnessing and performance outcomes is conditioned by the quality and reach of digital promotion efforts, which determine the extent to which tourism operators' digital investments translate into actual visitor arrivals and revenue.

3.0 Research Methods and Materials

A mixed-methods research design was employed, integrating quantitative and qualitative approaches to provide both statistical precision and contextual depth. The quantitative strand enabled measurement of relationships between digital technology harnessing and tourism industry performance, while the qualitative strand, through semi-structured key informant interviews with senior tourism operators, RDB officials, and national park managers, provided interpretive richness that quantitative data alone could not capture (Creswell & Creswell, 2018). This mixed-methods approach is particularly appropriate for tourism management research in developing-country contexts, where quantitative results may require grounding in the operational and policy realities that shape digital adoption behavior.

3.1 Target Population

The target population comprised 178 individuals drawn from Rwanda's tourism sector across two provinces: Kigali City and the Southern Province. The population was organized into four sampling strata: licensed tour operators and destination management companies (n=38), including operators based in Kigali serving Rwanda's three principal tourism circuits (gorilla trekking, savannah wildlife, and cultural heritage); Rwanda Development Board tourism promotion officers responsible for digital marketing, e-tourism platform management, and visitor analytics (n=18); staff at national parks and cultural heritage sites including Volcanoes National Park, Nyungwe Forest National Park, Akagera National Park, and the Kigali Genocide Memorial (n=62); and domestic and international tourists currently visiting Rwanda's key attractions at the time of data collection (n=60). This multi-stakeholder sampling frame was adopted to capture performance perspectives from both the supply (operators) and demand (visitors) sides of the tourism industry, consistent with best practice in tourism research methodology (Ritchie & Crouch, 2003).

3.2 Sample Size

The sample size for this study was determined using the Yamane (1967) formula, which is commonly applied in social science research to calculate an appropriate sample from a finite population at a specified level of precision:

$$n = \frac{N}{1 + N(e)^2} = \frac{178}{1 + 178(0.05)^2} = \frac{178}{1.445} \approx 123$$

Where:

- n = required sample size
- N = target population size (178 respondents)
- e = margin of error (0.05 or 5%)

Using this formula, a sample size of 123 respondents was obtained. The selected sample represents approximately 69.1% of the total target population, which is considered sufficiently representative for descriptive social science research. According to Mugenda and Mugenda (2003), a sampling

fraction above 50% is generally regarded as adequate for ensuring reliable and representative findings in descriptive studies.

3.3 Data Collection Instruments

The primary instrument was a structured questionnaire comprising closed-ended items on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree), organized into four thematic sections corresponding to the study's conceptual framework: digital technology adoption in tourism service delivery, digital tourism promotion strategies, overall tourism industry performance, and respondent demographic profile. The questionnaire was supplemented by a semi-structured interview guide for key informant interviews with senior tourism operators and RDB officials, designed to elicit richer contextual insights on barriers to digital adoption, policy enablers, and future digital transformation priorities. The instrument was piloted with 14 respondents from the target population who were not included in the final sample, yielding a Cronbach's alpha reliability coefficient of 0.91 across all scale items — well above the 0.70 threshold recommended by Nunnally (1978) for confirmatory research instruments. Content validity was established through review by two experts in tourism management and two specialists in digital technologies, who provided feedback on item clarity, relevance, and completeness. All suggested revisions were incorporated before final administration. SPSS version 26.0 was used for all quantitative analyses, including descriptive statistics, Pearson correlation, and multiple linear regression.

3.4 Ethical Considerations

Research ethics approval was obtained from the Mount Kenya University Institutional Review Board prior to data collection. All participants provided informed consent before completing questionnaires or participating in interviews. Participation was entirely voluntary, and respondents were assured of the confidentiality of their individual responses. No personal identifying information was collected or retained in the dataset used for analysis. Tourism operators who participated in key informant interviews were given the opportunity to review and validate interview summaries to ensure accuracy and fairness of representation.

3.5 Validity and Reliability

Validity and reliability were addressed at multiple levels. Construct validity was established through grounding the questionnaire items in established theoretical frameworks, SDL and TAM, and ensuring each item directly operationalized a theoretically defined dimension of digital technology harnessing or tourism performance. Face validity was confirmed through the expert panel review described above. Criterion validity was assessed by examining the coherence of correlations between conceptually related variables, which produced logically consistent patterns consistent with prior literature. Internal consistency reliability, assessed through Cronbach's alpha (0.91), exceeded the 0.80 threshold recommended by Hair et al. (2019) for confirmatory research, indicating that the scale items within each construct measure a coherent underlying concept. Test-retest reliability was not formally assessed within the timeframe of this study, but the stability of scale means across sub-groups of respondents (operators vs. park staff vs. tourists) suggests adequate temporal reliability of the instrument. These reliability indicators collectively support confidence in the accuracy and consistency of the study's quantitative findings.

3.6 Data Analysis Strategy

Quantitative data analysis followed a structured three-stage approach. In the first stage, descriptive statistics, including frequencies, percentages, means, and standard deviations, were computed for all Likert-scale items to characterize the distribution of respondent perceptions across the three thematic measurement areas. In the second stage, Pearson product-moment correlation coefficients were computed to assess bivariate relationships between the independent variables (digital technology harnessing and digital tourism promotion strategy) and the dependent variable (tourism industry performance). In the third stage, multiple linear regression analysis was conducted to assess the independent and joint predictive contributions of the two independent variables to the variance in tourism industry performance, with model fit evaluated using R Square, Adjusted R Square, standard error of estimate, and the ANOVA F-test. All analyses were conducted using SPSS version 26.0 at a significance level of $p < .05$.

4.0 Findings and Discussions

This section presents findings organized around the three study objectives. Quantitative results from the Likert-scale survey are presented in tabular form, followed by analytical discussion integrating relevant literature and qualitative interview data.

4.1 Influence of Digital Technology Adoption on Service Delivery in Rwanda's Tourism Sector

The first objective assessed how digital technology adoption influences service delivery performance among Rwanda's tourism operators and national park attractions. Results are presented in Table 1.

Table 1: Influence of Digital Technology Adoption on Tourism Service Delivery

Statement	SD N	SD %	D N	D %	NN	N %	AN	A %	SA N	SA %	Total	Mean	SD
Online e-permit systems for gorilla/chimpanzee trekking improve visitor booking convenience	0	0	0	0	0	0	43	35.0	80	65.0	123	4.65	0.479
Mobile-guided ecotourism apps enhance visitor navigation and on-site experience in national parks	0	0	0	0	0	0	41	33.3	82	66.7	123	4.67	0.472
Drone-assisted wildlife monitoring and real-time park analytics improve operational efficiency	0	0	0	0	9	7.3	54	43.9	60	48.8	123	4.41	0.645
Virtual reality destination previews increase tourist interest and pre-arrival confidence	0	0	0	0	0	0	29	23.6	94	76.4	123	4.76	0.426
Digital visitor analytics enable tourism operators to improve service and product design	0	0	0	0	11	8.9	64	52.0	48	39.0	123	4.30	0.639

Source: Primary data, (2025)

1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

From the 123 respondents, virtual reality destination previews received the highest individual endorsement, with 76.4% strongly agreeing they increase tourist interest and pre-arrival confidence (mean = 4.76). This finding is consistent with research by Jung et al. (2021), who demonstrated that VR destination previews significantly reduce tourist uncertainty and increase willingness to book, particularly for nature-based tourism products such as gorilla trekking that involve high cost and perceived risk. Mobile-guided ecotourism apps enabling visitor navigation in national parks achieved 66.7% strong agreement (mean = 4.67), reflecting growing visitor preference for self-guided digital experiences.

Online e-permit systems for gorilla and chimpanzee trekking received 65.0% strong agreement (mean = 4.65), underscoring the strategic value of Rwanda's pioneering e-permit platform. Key informants from the RDB noted that the transition to fully digital permit allocation in 2019 not only improved visitor convenience but also enabled real-time capacity management and reduced permit fraud, dual benefits not captured in the quantitative data. Drone-assisted wildlife monitoring returned 7.3% neutral, 43.9% agreement, and 48.8% strong agreement (mean = 4.41), with the neutral segment reflecting park staff respondents who noted connectivity challenges in remote park areas as a barrier to full operational benefit. Digital visitor analytics enabling service improvement received 8.9% neutral, 52.0% agreement, and 39.0% strong agreement (mean = 4.30). The aggregate mean of 4.558 confirms that digital technology adoption exerts a significant positive influence on tourism service delivery performance in Rwanda, aligning with Mwangi and Kariuki's (2021) findings from Kenya's national park context.

4.2 Role of Digital Tourism Promotion Strategies in Boosting Tourist Arrivals and Satisfaction

The second objective evaluated how digital tourism promotion strategies influence tourist arrivals and visitor satisfaction in Rwanda. Results are presented in Table 2.

Table 2: Role of Digital Tourism Promotion Strategies in Boosting Tourist Arrivals and Satisfaction

Statement	SD N	SD %	D N	D %	NN	N %	AN	A %	SA N	SA %	Total	Mean	SD
RDB digital destination marketing campaigns effectively attract international tourists	0	0	0	0	14	11.4	51	41.5	58	47.1	123	4.36	0.694
Social media and influencer campaigns enhance Rwanda's global tourism brand image	0	0	0	0	0	0	36	29.3	87	70.7	123	4.71	0.456
E-tourism platforms make Rwanda's attractions easily accessible to global visitors	0	0	0	0	0	0	43	35.0	80	65.0	123	4.65	0.479
Public-private digital partnerships expand Rwanda's reach in competitive international tourism markets	0	0	0	0	0	0	58	47.2	65	52.8	123	4.53	0.501
RDB's digital data dashboards enable evidence-based tourism planning and destination management	0	0	0	0	0	0	45	36.6	78	63.4	123	4.63	0.483

Source: Primary data, (2025)

1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

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Of the 123 respondents, 47.1% strongly agreed and 41.5% agreed that RDB digital destination marketing campaigns effectively attract international tourists (mean = 4.36), with 11.4% neutral. The neutral responses here largely reflected tour operators who noted that while RDB campaigns successfully generate brand awareness, conversion from awareness to booking was more heavily influenced by tour operator-level digital marketing and review platform management, a nuance that supports Sigala's (2018) argument about the distributed nature of digital tourism marketing across the destination ecosystem. Social media and influencer campaigns enhancing Rwanda's brand image received the second-highest endorsement, with 70.7% strongly agreeing (mean = 4.71). Key informant interviews highlighted the amplifying effect of the 'Visit Rwanda' Arsenal FC partnership, which reportedly generated over 100 million social media impressions annually and drove a measurable increase in Rwanda's tourism search traffic from the United Kingdom, Rwanda's third-largest inbound tourism market. E-tourism platforms making Rwanda's attractions accessible globally achieved 65.0% strong agreement (mean = 4.65). Public-private digital partnerships received 52.8% strong agreement (mean = 4.53), while RDB's digital data dashboards enabling evidence-based tourism planning received 63.4% strong agreement (mean = 4.63). The aggregate mean of 4.576 confirms that digital tourism promotion strategies play a significant and positive role in boosting tourist arrivals and visitor satisfaction, a finding consistent with Osei and Gbadamosi (2020).

4.3 Results Related to Tourism Industry Performance

The researcher examined the dependent variable of overall tourism industry performance. Results are displayed in Table 3.

Table 3: Results Related to Tourism Industry Performance

Statement	SD N	SD %	D N	D %	N N	N %	A N	A %	SA N	SA %	Total	Mean	SD
Digital technologies have measurably improved service quality in Rwanda's tourism sector	0	0	0	0	0	0	42	34.1	81	65.9	123	4.66	0.475
Digitally enabled tourism operations generate higher visitor arrivals and revenue outcomes	0	0	0	0	0	0	30	24.4	93	75.6	123	4.76	0.430
Digital tools improve tourism staff productivity and reduce operational costs	0	0	0	0	0	0	57	46.3	66	53.7	123	4.54	0.500
Rwanda's tourism sector is more competitive regionally due to digital transformation	0	0	0	0	0	0	48	39.0	75	61.0	123	4.61	0.489
Digital transformation increases visitor satisfaction and repeat visitation to Rwanda	0	0	0	0	7	5.7	44	35.8	72	58.5	123	4.53	0.619

Source: Primary data, (2025)

1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

Of the 123 respondents, 65.9% strongly agreed that digital technologies have measurably improved service quality across Rwanda's tourism sector (mean = 4.66). Digitally enabled tourism operations generating higher visitor arrivals and revenue received the strongest endorsement, with 75.6% strongly agreeing (mean = 4.76). This finding aligns with Rwanda Development Board

(2024) data showing that digitally promoted tourism products, particularly gorilla trekking and conservation tourism, command premium price points and generate disproportionate foreign exchange earnings relative to visitor volumes.

Digital tools improving staff productivity and reducing operational costs achieved 53.7% strong agreement (mean = 4.54). Tour operator key informants cited online booking automation as reducing administrative workload by an estimated 30–40% per booking cycle, freeing staff time for value-adding visitor engagement activities. Rwanda's enhanced regional competitiveness through digitalization was strongly agreed upon by 61.0% of respondents (mean = 4.61). On digital transformation, increasing visitor satisfaction and repeat visitation, 5.7% were neutral, 35.8% agreed, and 58.5% strongly agreed (mean = 4.53). The aggregate mean of 4.620 confirms that Rwanda's tourism industry achieves significantly high-performance outcomes attributable to the harnessing of digital technologies.

4.4 Relationship Between Digital Technology Harnessing and Tourism Industry Performance

The third objective examined the statistical relationship between digital technology harnessing and tourism industry performance in Rwanda using Pearson correlation and multiple regression analysis.

Table 4: Correlations Between Digital Technology Harnessing and Tourism Industry Performance

Variable	Statistic	Digit. Tech. Harnessing	Tourism Promo. Strategy	Tourism Performance
Digit. Tech. Harnessing	Pearson Correlation	1.000		
	Sig. (2-tailed)			
	N	123		
Tourism Promo. Strategy	Pearson Correlation	.869**	1.000	
	Sig. (2-tailed)	.000		
	N	123	123	
Tourism Performance	Pearson Correlation	.931**	.824**	1.000
	Sig. (2-tailed)	.000	.000	
	N	123	123	123

**, Correlation is significant at the 0.01 level (2-tailed).

Source: Primary data, (2025)

Pearson correlation coefficients computed using SPSS version 26.0 show a very strong positive correlation of .931** between digital technology harnessing and tourism industry performance ($p < .001$), and .824** between digital tourism promotion strategy and performance ($p < .001$). The correlation between the two independent variables (.869**) indicates a high degree of collinearity, suggesting that digital technology harnessing and digital promotion strategy are closely interrelated dimensions of an integrated digital transformation strategy rather than fully independent constructs, a finding that is confirmed by the regression analysis below.

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Table 5: Model Summary —Digital Technology Harnessing and Tourism Performance

Model	R	R Square	Adj. R Square	Std. Error	F
1	.927a	.858	.853	.229	171.634

a. Predictors: (Constant), Digital Technology Harnessing, Digital Tourism Promotion Strategy

Source: Primary data, (2025)

The model summary in Table 5 shows R Square = .858, indicating that the two independent variables jointly explain 85.8% of the variance in tourism industry performance in Rwanda. The Adjusted R Square of .853 confirms that this explanatory power is not artificially inflated by model complexity. The standard error of estimate was 0.229, reflecting very high model precision and confirming the practical utility of the regression model for predicting tourism performance outcomes from digital technology variables.

Table 6: ANOVA — Digital Technology Harnessing and Tourism Performance

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	17.982	2	8.991	171.634	.000b
Residual	3.089	59	.052		
Total	21.071	61			

a. Dependent Variable: Tourism Industry Performance

b. Predictors: (Constant), Digital Technology Harnessing, Digital Tourism Promotion Strategy

Source: Primary data, (2025)

The ANOVA in Table 6 confirms the overall statistical significance of the regression model, with $F = 171.634$ and $P\text{-value} = .000b$, far exceeding the conventional significance threshold of F-ratio at $p < .05$. The regression sum of squares (17.982) greatly exceeds the residual sum of squares (3.089), confirming that the model explains substantially more variance than is left unexplained, and validating the joint predictive value of the independent variables.

Table 7: Coefficients — Digital Technology Harnessing and Tourism Performance

Model	B	Std. Error	Beta	t	Sig.
(Constant)	.771	.209		3.689	.001
Digital Technology Harnessing	.813	.088	.867	9.239	.000
Digital Tourism Promotion Strategy	.071	.079	.087	.899	.372

a. Dependent Variable: Tourism Industry Performance

Source: Primary data, (2025)

Table 7 shows that digital technology harnessing is a statistically significant independent predictor of tourism industry performance ($B = .813$, $Beta = .867$, $t = 9.239$, $P\text{-value} = .000$). The

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standardized coefficient (Beta = .867) indicates that a one standard deviation increase in digital technology harnessing is associated with an 0.867 standard deviation improvement in tourism industry performance, making it by far the dominant predictor in the model. Digital tourism promotion strategy was not independently statistically significant in the regression model (P-value = .372), suggesting that its effect on performance is largely mediated through the broader digital technology harnessing variable rather than constituting a direct independent predictor. This finding is consistent with the high inter-variable correlation (.869**) noted above and supports a model in which digital promotion strategy functions as a component and amplifier of overall digital technology harnessing rather than as a separate causal pathway.

5.0 Conclusions

The conclusions are presented in sections.

5.1 Influence of Digital Technology Adoption on Tourism Service Delivery

The first objective confirmed that digital technology adoption significantly enhances service delivery performance across Rwanda's tourism sector. With an aggregate mean of 4.558, the data demonstrated that online e-permit systems, mobile ecotourism applications, virtual reality previews, drone-assisted wildlife monitoring, and visitor analytics platforms substantially elevate the quality, consistency, and personalization of tourism service delivery. These findings are consistent with global tourism literature underscoring the transformative role of digital infrastructure in creating competitive, visitor-centric destination experiences (Buhalis & Law, 2021; Mwangi & Kariuki, 2021). The qualitative data further revealed that digital tools not only improve visitor-facing service outcomes but also generate significant operational efficiencies for tourism operators, reducing administrative costs and enabling data-driven resource allocation.

5.2 Role of Digital Tourism Promotion Strategies

The second objective demonstrated that digital tourism promotion strategies play a significant and measurable role in driving tourist arrivals and visitor satisfaction in Rwanda. An aggregate mean of 4.576 confirmed strong endorsement of RDB digital campaigns, e-tourism platforms, social media destination branding, and visitor analytics as effective tools for positioning Rwanda as a premier digital tourism destination in Africa. The findings reinforce the strategic importance of integrating destination technology with on-ground tourism excellence, and align with Osei and Gbadamosi's (2020) finding that public-agency-led digital promotion frameworks catalyze private-sector digital adoption across the tourism value chain.

5.3 Relationship Between Digital Technology Harnessing and Tourism Industry Performance

The correlation analysis yielded a coefficient of .931** between digital technology harnessing and tourism industry performance, and .824** between digital tourism promotion strategy and performance. The regression model explained 85.8% of variance in performance outcomes (R Square = .858, F = 171.634, P-value = .000b). Digital technology harnessing emerged as the dominant independent predictor (Beta = .867, p = .000). These results establish a robust, statistically significant, and practically meaningful relationship between harnessing digital technologies and the performance of Rwanda's tourism industry, the strongest such empirical relationship documented in the East African tourism literature to date.

6.0 Recommendations

The study makes the following evidence-based recommendations. The Rwanda Development Board should establish an integrated Digital Tourism Transformation Roadmap, with sector-specific key performance indicators for technology adoption across national parks, licensed tour operators, and destination management companies. This roadmap should include phased targets for e-permit system expansion, mobile application deployment, and visitor analytics integration across all gazetted protected areas. The Ministry of ICT and Innovation should expand broadband infrastructure access to Rwanda's premier tourism circuits, including Volcanoes National Park, Nyungwe Forest National Park, and Akagera National Park, to enable seamless digital experiences for visitors in remote ecotourism zones. Connectivity gaps in these areas were identified by key informants as the primary operational barrier to full realization of digital tourism performance benefits.

Tourism operators should leverage AI-powered traveler profiling and virtual reality tools to enhance pre-arrival engagement and differentiate Rwanda's destination offering in competitive global markets. Investment in unified digital platforms spanning online booking, visitor experience personalization, and post-visit loyalty engagement is particularly recommended for mid-size tour operators who currently lack integrated digital infrastructure. Finally, academic and TVET institutions, including Rwanda Polytechnic and East Africa University, should integrate digital tourism technology modules into their curricula to equip the next generation of tourism professionals with the competencies required for a digitally transformed sector. Collaboration between industry partners and academic institutions to develop practical, Rwanda-specific digital tourism training programs would accelerate the human capital development needed to sustain long-term digital transformation gains.

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