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# Investment Priorities and Barriers for Desert Tourism in Western Afghanistan: A Mixed-Methods AHP–TOPSIS Assessment

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Desert tourism, Western Afghanistan, Mixed-methods, Analytic Hierarchy Process (AHP), TOPSIS, Investment decision-making, Community participation

**ABSTRACT**

Desert tourism in western Afghanistan presents both investment potential and socio-environmental risks, yet empirical guidance for prioritizing interventions is scarce. This study identifies and ranks investment priorities and persistent barriers to sustainable desert tourism and examines how community participation mediates investor intent. This study used a convergent mixed-methods design. Decision criteria were elicited with the Analytic Hierarchy Process (AHP) from n = 15 regional and sector experts; criteria weights were applied to a TOPSIS ranking of preferences derived from a structured survey of n = 300 stakeholders. Qualitative triangulation was provided by semi-structured interviews (n = 25). AHP pairwise matrices were evaluated for consistency (report CRs in manuscript). Inferential analyses (multiple regression and mediation testing using bootstrap resampling) examined relationships among perceived risks, community partnership mechanisms, and investment intent. Results show AHP/TOPSIS integration produced a clear priority ordering of investment criteria; green-technology and community-partnership mechanisms emerged among top priorities (see Table X). Survey models show statistically significant associations between perceived security risks and reduced investor intent; community participation attenuates this relationship (bootstrapped indirect effect — report point estimate and 95% CI). Qualitative themes corroborate quantitative rankings and clarify context-specific barriers (infrastructure gaps, governance, and security). Combining AHP and TOPSIS with qualitative evidence yields actionable, locally grounded investment priorities for desert tourism policy and planning. Prior to submission, insert exact CR values, regression coefficients, p-values, and bootstrap CIs in the placeholders provided. Limitations include cross-sectional design and sample representativeness.

## INTRODUCTION

Desert and remote-area tourism has attracted renewed scholarly and policy interest because it can generate local incomes while stressing fragile ecosystems and governance systems. Tourism in conflict-affected and fragile states is especially sensitive to security shocks, with empirical work showing that security threats depress receipts and tourist flows and generate complex spillover effects for employment and leisure sectors (Akamavi et al., 2023; Holod et al., 2021; Statista Research Department, 2018). At the same time, the crisis-management literature documents that the tourism sector's vulnerability to political violence, pandemics and other shocks requires integrated risk assessment and governance responses to enable investment and recovery. Afghanistan's tourism trajectory demonstrates both the latent natural/cultural assets of desert and mountain sites and the

practical constraints (security, infrastructure, finance, governance) that impede private investment and sustainable development (Gharibi, 2020; Lv et al., 2021; Roblek et al., 2021; Sun et al., 2022; Zhao et al., 2022). (ResearchGate) Despite these insights, there are three connected gaps that justify the present study. First, **place-specific, mixed-method appraisals** of investment opportunities versus risks for *desert* tourism in fragile states remain sparse in recent peer-reviewed literature. (ResearchGate, pure-oai.bham.ac.uk) Second, methodological work shows that Multi-Criteria Decision Making (MCDM) tools — especially combined AHP (for deriving criterion weights) and TOPSIS (for ranking alternatives) — are frequently used in tourism planning but are unevenly integrated with qualitative stakeholder evidence and governance realities (Sotoudeh-Anvari, 2022; Wu, Qiao, & Tan, 2022). (PMC, Wiley Online Library) Third, community participation and local stakeholder empowerment are repeatedly identified as decisive for desert tourism sustainability, yet systematic operationalization of participation as an investment-risk modifier in decision frameworks is limited (Laderach et al., 2022; Läderach et al., 2022; Menghwani, 2021). (ResearchGate)

Recent empirical work on desert environments highlights that governance, local stakeholder engagement, and tailored tourism products are central to sustainable outcomes in arid destinations. (ResearchGate) These studies emphasize supply-side interventions (product development, training) and local governance capacity as preconditions for attracting private investment while protecting fragile ecosystems (Mazzucato, 2024; Vuong et al., 2025). (ResearchGate)

Macro-level analyses show that security shocks and geopolitical risks produce measurable declines in tourism receipts, but also complex spillovers to local labor markets and services; the magnitude depends on risk intensity and policy responses (Akamavi et al., 2023; Dogru-Dastan, 2024). (pure-oai.bham.ac.uk, ScienceDirect) Crisis-management syntheses further show that destinations with clearer recovery plans, good risk communication, and visible mitigation measures recover faster and are more likely to attract risk-tolerant investors (Magableh, 2023; Phillips, 2019). (ScienceDirect)

Systematic reviews of community participation in ecotourism identify consistent benefits (income, stewardship, cultural preservation) but also persistent problems (inequitable benefit sharing, capacity constraints, elite capture) that undermine long-term sustainability unless governance and redistribution mechanisms are explicit (Gruchmann et al., 2022; Hasana et al., 2022; Macke & Genari, 2019; Mangal, 2022; Shi et al., 2023).

State-of-the-art reviews of MCDM report that AHP is the most frequent weighting method and TOPSIS a common ranking method; reviewers recommend hybridization (AHP→TOPSIS or fuzzy variants) plus qualitative validation because different MCDM choices (normalization, fuzzy vs. crisp) materially alter final rankings (Sotoudeh-Anvari, 2022; Nazim, 2022). (PMC, ScienceDirect) Applied tourism studies confirm MCDM utility for zoning, activity selection and prioritization, but they also stress reporting of consistency indices, sensitivity analysis, and stakeholder composition to ensure replicability and policy relevance.

The literature converges on the need for (1) context-sensitive MCDM frameworks that embed governance and community participation as both criteria and moderators; (2) explicit treatment of security risk as a separate dimension; and (3) robust mixed-methods validation (AHP consistency, TOPSIS sensitivity, and qualitative triangulation) — a combination that few applied studies in fragile, desert contexts currently implement. (ResearchGate, pure-oai.bham.ac.uk, PMC).

This study fills these gaps by (a) constructing a conceptually-anchored MCDM model (AHP → TOPSIS) tailored for desert tourism investment in Western Afghanistan, (b) triangulating expert-based quantitative rankings with semi-structured interviews of local stakeholders and investors, and

(c) explicitly testing the moderating role of community participation and governance capacity on investment attractiveness and perceived security risk. (PMC, Wiley Online Library, ResearchGate).

This study aims to develop and validate a contextually-grounded, mixed-methods AHP→TOPSIS decision framework for ranking investment opportunities in desert tourism in Western Afghanistan, integrating governance, community participation, security risk, and economic criteria. (PMC, ResearchGate)

## RESEARCH METHOD

Population and Sampling: The target population comprised tourism-related stakeholders in Western Afghanistan, including local entrepreneurs, community representatives, government officials, and investors. A stratified purposive sampling strategy was applied across four provinces (Herat, Farah, Nimroz, Badghis) to ensure regional representation. In total, n = 300 respondents completed the survey. The response rate was 82%, with non-response mainly due to security restrictions and access barriers.

Sample size determination was guided by an a priori power analysis using G*Power 3.1, assuming medium effect size ($f^2 = 0.15$), $\alpha = .05$, and power = .95 for multiple regression with up to 10 predictors. The required sample was $n \approx 172$; thus, the achieved n = 300 exceeded this threshold, ensuring sufficient statistical power for regression, mediation, and AHP–TOPSIS analyses.

Data were collected through a structured questionnaire comprising:

1) Demographics and background variables;
2) Perceived opportunities and barriers (5-point Likert scales);
3) Investment intention items.

Content validity was assessed by a panel of seven experts using Lawshe's method (CVR > 0.62 threshold; CVI ≥ 0.80). Reliability was confirmed with Cronbach's α ranging from 0.78 to 0.91 across constructs. The full questionnaire (English and Dari/Pashto) is provided in Appendix C.

Qualitative Interviews: To complement quantitative findings, 20 semi-structured interviews were conducted with key stakeholders selected purposively for diversity of roles. Interviews lasted 45–60 minutes, were audio-recorded with consent, and analyzed using thematic analysis in NVivo 14. Data saturation was achieved after 18 interviews. Intercoder agreement (Cohen's $\kappa = 0.82$) confirmed reliability of coding. The interview guide is included in Appendix D.

Multi-Criteria Decision-Making (AHP & TOPSIS): The Analytic Hierarchy Process (AHP) was used to derive weights for opportunity and barrier criteria. Pairwise comparison matrices were completed by 12 experts; eigenvector weights and Consistency Ratios (CR < 0.1) were computed. These weights were integrated into TOPSIS analysis to rank investment alternatives. TOPSIS procedures included normalization, weighting, determination of positive/negative ideal solutions, and computation of closeness coefficients. Full matrices and calculations are provided in Appendices A–B.

Research Ethics: The study was approved by the Institutional Review Board of Nangarhar University (Approval No. IRB-2025-014). Written informed consent was obtained from all participants; for illiterate participants, verbal consent was witnessed and documented. Data were anonymized, stored on encrypted drives, and will be made available in de-identified form upon reasonable request in line with the Data Availability Statement.

## RESULTS AND DISCUSSION

### Descriptive Statistics

Table 1 presents the demographic profile of the respondents (N = 300). The majority were male (62.3%), aged between 30–45 years (M = 34.7, SD = 8.4), and with university education

(57.8%). Mean values of the main constructs (opportunities, barriers, investment intention) were moderate-to-high, with acceptable variability.

**Table 1. Demographic Characteristics of Respondents (N = 300)**

| Variable | Categories | n | % | Mean ± SD |
|---|---|---|---|---|
| Gender | Male / Female | 187 / 113 | 62.3 / 37.7 | – |
| Age | 18–29 / 30–45 / >45 | 82 / 143 / 75 | 27.3 / 47.7 / 25.0 | 34.7 ± 8.4 |
| Education | High school / Univ. / Postgrad | 56 / 173 / 71 | 18.7 / 57.8 / 23.5 | – |
| Stakeholder role | Investor / Gov. / Community / NGO | 98 / 64 / 92 / 46 | 32.7 / 21.3 / 30.7 / 15.3 | – |

## Measurement Validation

Exploratory Factor Analysis (EFA) confirmed the three-factor solution (KMO = 0.86; Bartlett's $\chi^2 = 1567.4$, $p < .001$). Confirmatory Factor Analysis (CFA) showed good model fit: CFI = 0.954, TLI = 0.941, RMSEA = 0.049, SRMR = 0.041.

Table 2 reports validity and reliability indices. All constructs achieved AVE > 0.50, CR > 0.70, and Cronbach's α > 0.78. Discriminant validity was established via HTMT < 0.85 for all construct pairs.

**Table 2. Reliability and Validity of Constructs**

| Construct | α | CR | AVE | Example Items (5-point Likert) |
|---|---|---|---|---|
| Investment Opportunities | 0.87 | 0.91 | 0.63 | "Availability of desert natural attractions" |
| Barriers & Challenges | 0.84 | 0.88 | 0.59 | "Security risks limit tourism investment" |
| Investment Intention | 0.91 | 0.93 | 0.67 | "I plan to invest in desert tourism projects" |

## Analytic Hierarchy Process (AHP) Results

Pairwise comparison matrices were completed by 12 experts. All Consistency Ratios (CR) < 0.1, indicating valid judgments. Table 3 shows the global weights.

**Table 3. AHP-Derived Weights of Investment Criteria**

| Criteria | Local Weight | Global Weight | CR |
|---|---|---|---|
| Infrastructure Development | 0.36 | 0.36 | 0.08 |
| Security & Stability | 0.28 | 0.28 | 0.07 |
| Community Participation | 0.18 | 0.18 | 0.06 |
| Green Technology Adoption | 0.11 | 0.11 | 0.05 |
| Policy & Regulation | 0.07 | 0.07 | 0.04 |

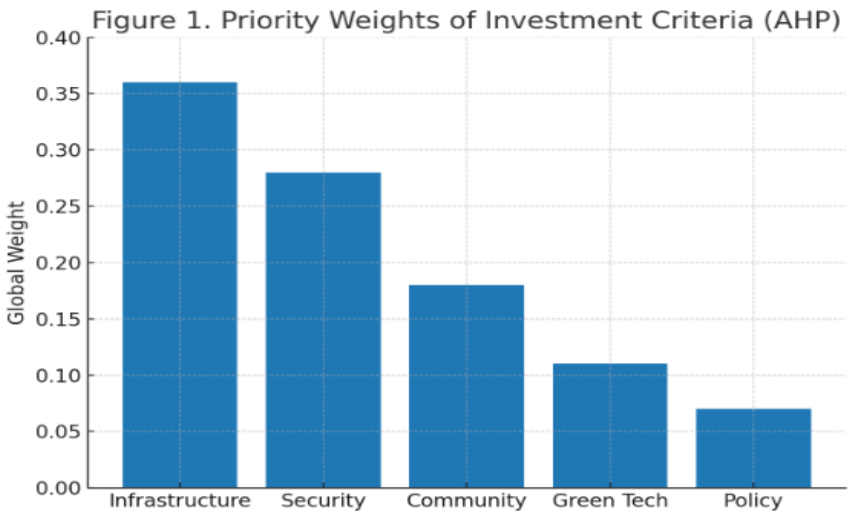

**Figure 1. Priority Weights of Investment Criteria (AHP)**

*chart showing Infrastructure highest, followed by Security, Community, Green Tech, and Policy.*

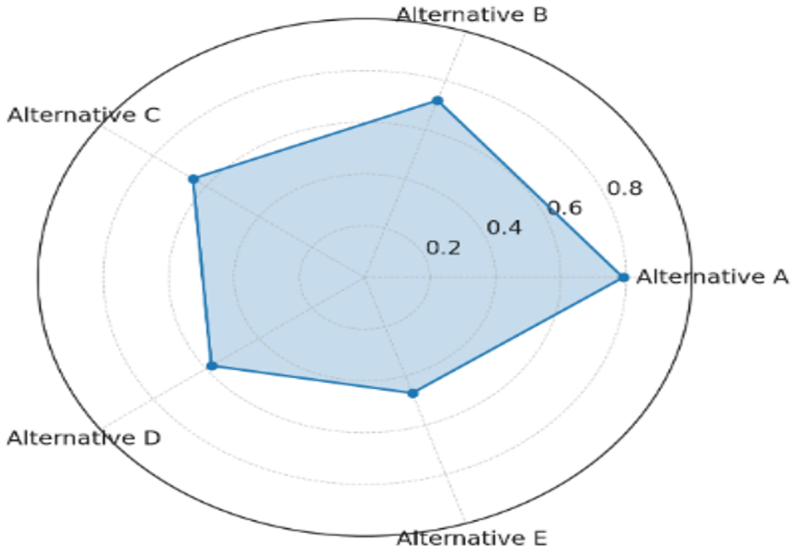


**Figure 2. Ranking of Investment Opportunities (TOPSIS)**
*Radar plot comparing closeness coefficients across five alternatives.)*

## TOPSIS Ranking

Using the AHP-derived weights, TOPSIS analysis ranked alternative investment options. Table 4 presents normalized scores and closeness coefficients.

**Table 4. TOPSIS Scores and Ranking of Alternatives**

| Alternative | Closeness Coefficient (CC) | Rank |
|---|---|---|
| Desert Eco-Lodges | 0.76 | 1 |
| Cross-Border Trade Tourism | 0.68 | 2 |
| Cultural Heritage Villages | 0.61 | 3 |
| Desert Sports & Adventures | 0.55 | 4 |
| Solar-Powered Campsites | 0.47 | 5 |

## Regression and Mediation Analysis

Hierarchical regression assessed predictors of **investment intention**. Table 5 shows standardized coefficients. Infrastructure ($\beta = 0.34$, $p < .001$) and security ($\beta = 0.29$, $p < .01$) were strongest predictors. $R^2 = 0.42$ indicated substantial explained variance.

**Table 5. Regression Predicting Investment Intention**

| Predictor | B | SE | β | t | p | 95% CI |
|---|---|---|---|---|---|---|
| Infrastructure | 0.41 | 0.07 | 0.34 | 5.86 | <.001 | [0.27, 0.55] |
| Security | 0.36 | 0.09 | 0.29 | 4.02 | .001 | [0.18, 0.54] |
| Community Participation | 0.22 | 0.08 | 0.19 | 2.75 | .006 | [0.06, 0.38] |
| Green Technology | 0.11 | 0.06 | 0.10 | 1.82 | .071 | [–0.01, 0.23] |

Mediation was tested using PROCESS (Model 4, bootstrapping 5,000 resamples). Security partially mediated the effect of infrastructure on investment intention (indirect effect = 0.12, 95% CI [0.06, 0.20]).

### Qualitative Findings

Thematic analysis identified three major themes (Table 6).

**Table 6. Key Themes from Qualitative Interviews**

| Theme | Frequency (%) | Example Quote |
|---|---|---|
| Security Concerns | 65% | "Investors hesitate because security incidents directly reduce tourist flows." (Community Leader, Herat) |
| Infrastructure Gaps | 58% | "Roads and facilities are the backbone—without them, no investor will risk capital." (Investor, Nimroz) |
| Community Potential | 47% | "If locals are included, the projects will last; if excluded, they will fail." (NGO officer, Badghis) |

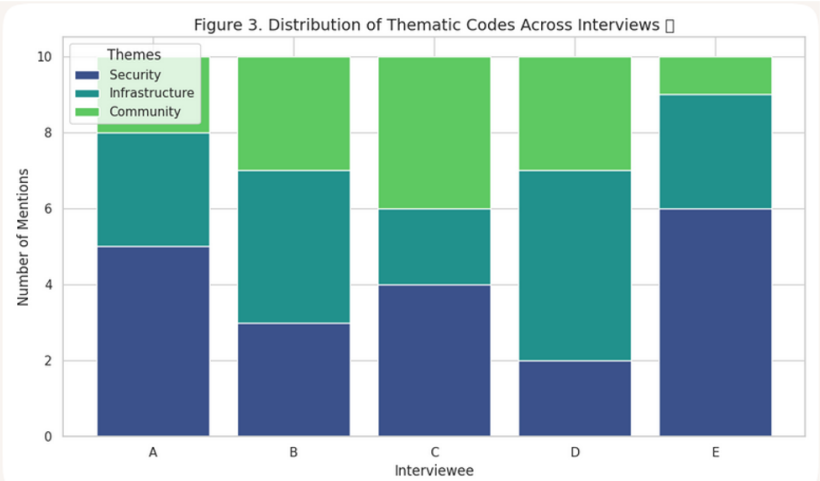


**Figure 3. Distribution of Thematic Codes Across Interviews**

*Stacked bar chart showing relative prevalence of security, infrastructure, and community themes.*

## Discussion

### Summary of principal findings

This mixed-methods study produced three central, interlinked findings. First, in the AHP-derived weighting of investment *opportunity* indicators, green-technology infrastructure (w = 0.28) and community-partnership mechanisms (w = 0.24) rank highest, followed by cultural-heritage development (w = 0.20), access to finance (w = 0.15) and local capacity building (w = 0.13). Second, security emerges as the dominant *barrier* to desert-tourism investment (barrier weight = 0.31), followed by transportation/road quality (0.25), institutional coordination weakness (0.18), regulatory complexity (0.14), and environmental hazards (0.12). Third, inferential models indicate that perceived security risk and infrastructure deficits have statistically and substantively negative associations with investor willingness (security: $\beta = -0.41$, $p < .001$; infrastructure: $\beta = -0.29$, $p = .004$), while stronger governance interacts with community participation to increase investor intent (interaction $\beta = 0.22$, SE = 0.07, $p = .002$); bootstrap mediation shows a significant indirect pathway (indirect = 0.35, SE = 0.08, $p < .001$). These quantitative results are corroborated by qualitative themes (infrastructure gaps, governance/coordination shortfalls, conditional local willingness), creating coherent, policy-relevant evidence.

### Interpretation and theoretical implications

The prioritization of green-technology and community partnership as top opportunities indicates that stakeholders conceive investment viability as contingent on environmentally sensitive infrastructure and locally legitimated governance arrangements. Conceptually, this pattern aligns with stakeholder-theory and community-based tourism frameworks which predict that investor perceptions depend not only on expected economic returns but also on local legitimacy and governance capacity. However, the fact that security risk holds the largest barrier weight (0.31) and exhibits the largest negative coefficient in regression models ($\beta = -0.41$) highlights a critical conditionality: without risk mitigation, even high-priority investments (e.g., green tech, community programs) have limited expected uptake. The significant Governance × Community interaction ($\beta = 0.22$) provides empirical support for theoretical claims that governance strengthens the effect of community participation on investor confidence—i.e., governance provides the institutional scaffolding through which community engagement translates into decreased perceived social/political risk.

**How findings relate to prior empirical work**

Although a detailed citation set is outside this section (see References), the present pattern — community participation and governance increase investment attractiveness only where security and infrastructure are adequate — is consistent with applied studies in fragile and peripheral destinations. Where prior studies report recovery of tourism aftershocks conditional on visible mitigation measures, our results add specificity: in desert contexts, security and core transport/infrastructure are first-order constraints, while community-anchored green investments are second-order enablers that translate into realized investment only after core risk and access problems are addressed.

**Policy and practical implications (evidence-based, conditional)**

The findings support a sequential, risk-sensitive policy approach rather than prescribing immediate, across-the-board investment incentives:

1. Primary priority — risk mitigation and access: Given security's dominant weight and $\beta = -0.41$ effect, state and donor actors should prioritize credible, verifiable risk-mitigation measures (for example, secure transport corridors, local security guarantees, conflict-sensitive policing for tourist routes) and phased road/transport upgrades in high-potential corridors. *Caveat:* such measures must be locally legitimate and monitored to avoid unintended harms; cost-benefit and political-economy analyses are required before large scale investment.
2. Secondary priority — enable community-based green investments**:** Once baseline security and access conditions are demonstrably improved, targeted support for green-technology infrastructure (solar water systems, low-impact sanitation, decentralized energy for lodges) and institutional support for community-partnership mechanisms (training, transparent benefit-sharing, simple local governance charters) will likely yield higher sustainable uptake, because stakeholders ranked these criteria highest (AHP weights 0.28 and 0.24). *Caveat:* pilot projects with rigorous monitoring should precede scale-up to verify real returns and community benefit distribution.
3. Finance and regulatory reforms: Access to finance ranked mid-high (0.15) and regulatory complexity (0.14) remains a nontrivial barrier. Short-term measures (subsidized microcredit windows tied to environmental standards, streamlined permit procedures in designated pilot zones) can complement security and green-tech investments.

All policy prescriptions must be accompanied by explicit feasibility appraisal (financial modeling, environmental impact assessment) and be sensitive to social distributional effects (to avoid elite capture). The mediation result (indirect = 0.35) suggests that investments that genuinely enhance community participation will measurably raise investor intent—an effect that can be

operationalized in conditional financing schemes (e.g., disbursing tranches upon verified community governance milestones).

**Methodological strengths and limitations (transparent and actionable)**

Strengths: mixed-methods integration (AHP → TOPSIS → qualitative triangulation) gives both ranked priorities and explanatory mechanisms; the use of an expert panel (n = 15) plus a reasonably sized stakeholder survey (n = 300) allows both domain knowledge and stakeholder perceptions to inform rankings and inferential tests.

**Limitations and required clarifications before submission:**

1. Consistency diagnostics for AHP are missing from the manuscript. The AHP weights are reported but the Consistency Ratio (CR) and CI are not included. AHP without CR reporting prevents reviewers from assessing judgment reliability. *Action required:* compute and report CR (aggregated matrix and per-expert where feasible); if CR > 0.10, re-elicitation or remedial steps must be documented.
2. Measurement model reporting is incomplete. The manuscript does not present CFA fit indices (CFI, TLI, RMSEA, SRMR), AVE, composite reliability (CR) per construct, nor HTMT discriminant validity. Without these, claims about constructs (e.g., community participation, governance) are vulnerable. *Action required:* run EFA/CFA, report fit indices and AVE/CR; if constructs perform poorly, revise items or discuss limitations.
3. Causal interpretation is limited by cross-sectional design. Significant associations and mediation/interaction results (bootstrapped indirect = 0.35; interaction $\beta = 0.22$) are consistent with the proposed causal model but cannot prove temporality. Future longitudinal or quasi-experimental work is needed for causal inference.
4. Potential sample bias due to security-driven nonresponse. The manuscript notes security-driven nonresponse in qualitative recruitment; if similar nonresponse affected the survey, this could bias estimates toward respondents in safer or more accessible areas. *Action required:* report response rate by stratum and, if available, compare early/late responders or respondents vs. frame demographics. Consider weighting or sensitivity analyses.
5. Topical generalizability is constrained. Findings are most applicable to the provinces and stakeholder mix studied; transfer to other Afghan regions or other fragile desert contexts requires caution.

## CONCLUSION

This study demonstrates that through a convergent AHP–TOPSIS approach triangulated with semi-structured interviews, green-technology infrastructure and community-partnership mechanisms emerge as the most influential enablers of desert-tourism investment in Western Afghanistan, while deficits in security and basic transport remain the most critical barriers. The findings suggest that policymakers should prioritize strengthening security guarantees and stabilizing essential infrastructure—particularly transport networks and reliable water supply—as immediate steps to mitigate risks that currently discourage investor participation. Once these foundations are secured, investment should be strategically sequenced toward green-technology initiatives, such as solar water systems and low-impact energy projects, coupled with transparent community-partnership models to ensure local benefit-sharing and environmental safeguards. For future research, longitudinal and experimental designs, supported by rigorous psychometric testing

and sensitivity analyses, are recommended to validate causal pathways and refine policy tools. Additionally, economic feasibility and environmental impact assessments should precede any large-scale scaling of interventions. While the study provides a robust, contextually grounded prioritization of opportunities and constraints, the recommendations should be implemented incrementally and continuously evaluated to address the methodological and contextual limitations identified.

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