

Assessing the impact of sustainable tourism practices on Petra and Wadi Rum

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Abstract

The focus of this study is on sustainable tourism and its impact on country's major historical sites, namely Petra and Wadi Rum. Taking a quantitative research paradigm, it assesses the impact of the sociocultural, economic, and environmental sustainability activities on the attitude and perception of internal stakeholders towards tourism. The study was performed on 214 participants by means of pre-designed questionnaires, semi-structured interviews and the review of other documents. The data obtained suggests that the impact of sustainability practices on the environmental outcomes and perceived effects is significant. On the contrary, the impact on economic growth and the protection of cultural heritage is negligible. The outcome underscores the advantages and disadvantages associated with the present sustainability strategies. Systems of sustainability that are effective for economic empowerment, cultural responsiveness, inclusiveness, and diversity are essential. To promote more sustainable and equitable tourism development within Jordan, developed strategies emphasize the need to enhance the growth of community-based tourism, improvement of cross-sector cooperation, and effective implementation of policies as advocacy goals and objectives.

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1. Introduction

Foreign exchange is earned from the large volume of job opportunities generated by the tourism sector of the economy in cross-cultural communication. The Jordanian economy, which also obtains income from exports, is boosted by remittances associated with Petra and Wadi Rum in the country [1]. These are among the most prominent tourist sites in Jordan which can be explored culturally and naturalistically, and which suffer from environmental degradation and social unrest [2]. As sustainability awareness gains attention, there is increasingly greater need to find a balance in tourism development, environmental conservation and community welfare [3]. Sustainable tourism's purpose is to have a maximum number of positive effects while keeping a minimum level of detrimental effects on indigenous communities, environments, and cultural signatures [4].

Jordan has worked towards embracing such measures, especially in UNESCO World Heritage Sites and popular tourist attractions like Wadi Rum and Petra [5]. The efforts involve environmental-friendly accommodations, waste management plans, community-based tourism patterns, and legislation for the protection of natural and cultural heritage [6]. This research aims to assess the sustainability and impact of such sustainable travel measures in Petra and Wadi Rum. With consideration of socio-cultural, economic, and environmental perspectives, the study will identify successes, issues, and potential improvement. The results will help to improve our knowledge on how the tourism policy of Jordan can incorporate sustainable tourism for the advantage of both tourists and the society more effectively. Despite the growing body of literature on sustainable tourism in Jordan, existing studies tend to examine Petra and Wadi Rum separately and often emphasize either environmental or economic factors, with limited integration of all three sustainability dimensions. Moreover, few studies combined quantitative assessment with stakeholder-informed qualitative insights to evaluate how current sustainability practices are perceived and where gaps remain. This creates a lack of holistic, site-comparative evidence that can guide national decision-making. Addressing this gap, the present study provides a comprehensive mixed-method assessment of environmental, economic, and sociocultural sustainability practices in both Petra and Wadi Rum. The study contributes to the new empirical evidence by 1) testing the statistical impact of sustainability practices on multiple outcome variables, 2) integrating stakeholder perspectives from semi-structured interviews, and 3) offering a comparative understanding of the two major world heritage sites. This multifaceted approach advances current knowledge by linking sustainability performance with stakeholder perception in a way not yet explored in Jordan's heritage tourism context.

To facilitate these aims, the research intends to answer the following questions:

1. What sustainable tourism initiatives exist in Petra and Wadi Rum?
2. What effects do these initiatives have on the ecosystem, regional development, and cultural resources?
3. How do the proponents of these sustainability advancement projects perceive the local populace, tourists, and tourism industry?
4. What are some of the limitations in implementing sustainable tourism in this region?
5. What are the recommendations that can be made to improve tourism sustainability in this region?

2. Literature review

2.1. Principles of sustainable tourism

The “sustainable tourism” mode of tourism management development, without neglecting development, is the balance of both sides [7]. It not only addresses the needs of the local population and current tourists but also considers the needs of future generations [8]. The framework of the current study is based on the three interlinked pillars of sustainable development including economics, sociocultural and environmental factors [9]. It is important to maintain biodiversity through the protection of fragile ecosystems and the sustainable, non-polluting use of resources [10]. This is particularly true for sites such as Petra and Wadi Rum, whose breathtaking natural beauty attracts tourists but is highly vulnerable to degradation [7]. The economic side mainly focuses on tourism as an economic development engine through the system of fair and equal employment opportunities, fair income distribution, and the continuous operation of tourism-related business units [11]. Because of the significant contribution of tourism to the GDP of Jordan and the livelihoods of the local population, it is relevant to address the balance of sustainable development factors with economic performance [12]. The goal of the sociocultural factor is to preserve the cultural identity, facilitate positive relations between tourists and local population, and to empower the local population through participation in management and decision making [13].

In order for the proposed frameworks to be fully understood and contextualized, they will have to be implemented through adaptive management, strategic planning, continuous evaluation, and partnership with

stakeholders [14], [15]. In the Petra and Wadi Rum case, however, there are some trade-offs and benefits that come with sustainable tourism [16]. This study is the first to holistically assess these three dimensions in two of the most frequented and biodiverse regions of the country. Such studies allow theoretical insights to be applied in socioculturally appropriate contexts, making sustainability frameworks more practical and relevant [17], [18]. This marks the beginning of critical sustainable tourism scholarship in Jordan. This literature review highlights the issue of the integration of the implementation and impact of the proposed sustainability policies on the economy, ecosystems, and society and their sustainable management frameworks. This research, on both theoretical and empirical level, is meant to help the construction of policies which promote social and environmental justice to be able to strengthen the tourism industry in certain areas of Jordan and the world.

2.2. Global and Jordanian perspectives on sustainable tourism

The integration of sustainable tourism into emerging research in various sociodemographic and geographic contexts has placed its practice to the top of the development agenda of the world for the 21st century [19]. There is much to learn from that research, both global and local, especially from the attempts to apply the principles of sustainability to the tourism destinations of Petra and Wadi Rum [20].

A regional investigation of sustainable tourism in the Middle East and North Africa (MENA) region by El Shafaki et al. [21] found that the most critical barriers to sustainable tourism development are environmental deterioration, lack of local community engagement, and insufficient protective legislation in place. Their focus on participation and open system governance structures has much to offer for tourism development in Jordan.

Pilelienè et al. [22] examined global innovations on sustainable tourism by bibliometric analysis and identified three research quadrants: management, sustainability, and smart/ICT. They argue that the emerging paradigms of tourism in the world will need to embrace cross boundary collaboration, and the ubiquitous application of ICT, which is crucial to the growing tourism infrastructure of Jordan.

Surya et al. [8] analyzed the management of sustainable tourism destination in Asia with the holistic framework of amenities, community empowerment, accessibility, and attractions. This is, perhaps, most relevant to heritage sites such as Petra, where the delicate balance of preserving and strategically nurturing environmental and cultural assets is critical to the visitation management processes.

Yanes et al. [11] relates a policy evaluation model for community-based tourism (CBT) developed for the poor countries to the argument that many national policies lack a framework to fully integrate community participation at the grassroots level. This is exactly the case, under the Jordanian context, where prospects for CBT projects are possible but are fundamentally driven by system-centric and monetary constraints.

CBT literature that is reviewed by Krittayarungroja et al. [12] indicates a change in focus of attention from developed to developing world. They highlighted stakeholder involvement, cultural preservation, and recovery from the pandemic as the three pillars of the tourism recovery plan for Jordan.

Baloch et al. [7] analyzed the impact of the environmental cost of tourism development in Pakistan from a comparative perspective of the South Asia region. They proposed a regulated ecologically sustainable approach towards ecotourism that emphasized environmental stewardship, community participation, and governance. These can be applied to the Jordanian desert such as the Wadi Rum.

Thullah and Jalloh [23] raised concern in their international study regarding the economics, social spheres, and environmental impact of tourism. Their concern was that, without regulatory controls, tourism would continue to deepen social inequalities and increase environmental degradation. Such evidence also emphasizes the core objective of this research, namely the need to perform a thorough sustainability analysis.

Hijawi and Ismaeel [24] address the impact of tourism on the environment from the perspective of the roles of salespeople in the integrated marketing communications of the Jordanian tourism industry. The research highlights the ways in which salespeople add value to the coherence of messages and the formation of customer relations, thus supporting both integrated and adaptive tourism marketing. This research illustrates the

effectiveness of salespeople in achieving promotional initiatives to bring about sustainable tourism development in the context of aligned communication strategies.

2.3. Hypothesis of the study

Guided by the research frameworks and extensive literature review undertaken, the following hypotheses are presented, each aimed at a principal dimension of sustainable travel—namely, environmental, economic, and socio-cultural—and specifically suited to the case studies of Petra and Wadi Rum:

- environmental factors

H₁: Sustainable tourist intervention implementation in Petra and Wadi Rum is key to reducing environmental degradation, for example, the generation of waste, depletion of resources, and interference with ecosystems.

This hypothesis supports international research [7], [8] by connecting conservation planning and sustainable infrastructure planning with quantifiable environmental improvement. It also supports local research [9], [25] on the environmental effects within Petra caused about by unsustainable tourism.

- economic aspect

H₂: Employment opportunities, entrepreneurship, and emerging streams of income all contribute to community-based ecotourism and local business ventures around Wadi Rum and Petra. Research conducted on this hypothesis at the local level, such as those developed by Jordanian researchers, (e.g., Alquran et al.) substantiates the arguments made in international discourse, also cited in this same page (e.g., [26], [27], [28]).

- sociocultural aspects

H₃: Petra's and Wadi Rum's tourism development enhances the preservation of cultural heritage and the construction of collective identity through participatory forms of tourism.

This hypothesis stems from the cultural preservation and empowerment of the people paradigm espoused in the works of Krittayaruangroja et al. [12] and the models of CBT in Latin America. Locally, Abuamoud [29] discusses the competing dynamics of heritage conservation and commercial exploitation, warranting the case of tourism the culture deserves.

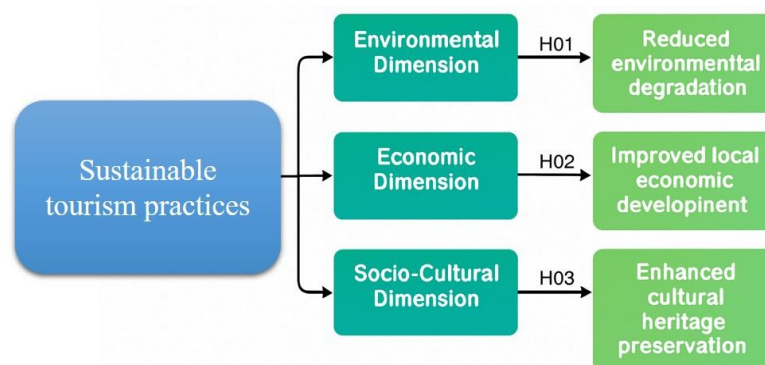


Figure 1. Study model

3. Research method

3.1. Research approach

The research design in this study is a mixed-method approach to research which incorporates mainly quantitative focus with some qualitative elements. A quantitative phase on the base of the structured survey carried on the visitors and the local stakeholder in Petra and Wadi Rum made it possible to statistically test the hypotheses concerning the environmental, economic, and sociocultural sustainability. The study also included semi-structured interviews with important stakeholders such as site managers, tourism operators and community leaders to add depth to these findings and a review of policy and management documents to put them in context.

The qualitative approach helps in creating a more comprehensive understanding of the practical issues, perceived effects, and place-specific dynamics of sustainability implementation that cannot be captured by survey data alone.

3.2. Research design and procedures

Petra and Wadi Rum were selected as research sites for this study since they both have a diverse tourist mix and are UNESCO World Heritage sites [30]. Wadi Rum is a case study of nature-based and community-based tourism, while Petra also experiences a high volume of cultural tourists [10]. Stratified random sampling process was employed to ensure that there was a representative sample from both the sites, and this resulted in a total of 214 respondents, who were both locals and foreign visitors.

Three primary data collection tools were used. A survey questionnaire was first constructed to measure attitudes towards sustainable tourism in three regions of special significance. The survey was conducted among tourists visiting Petra and Wadi Rum directly and indirectly, using a mix of closed-ended and Likert-scale questions. Second, semi-structured interviews were conducted with key local stakeholders such as government institutions, tour operators, site managers, and community leaders. These interviews were meant to provide qualitative understanding of issues involved in the implementation of sustainable practices. Third, policy document analysis was carried out for measuring congruence between policy objectives and results through the analysis of national tourist policies, standards of sustainability, and site-specific management plans. The questionnaire included items measuring environmental sustainability (e.g., waste management, eco-lodging), economic sustainability (e.g., employment opportunities, entrepreneurship), and sociocultural sustainability (e.g., heritage preservation, community participation). Reliability was confirmed with Cronbach's alpha values above 0.70 for all constructs, and content validity was established through expert review. Factor analysis supported construct validity, ensuring that the items accurately reflected the intended dimensions.

3.3. Scale sources and development

The questionnaire items used in this research were based on established and validated scales commonly used in sustainable tourism research. The items on environmental sustainability were based on Baloch et al. [7], and Surya et al. [8], who created the indicators of the ecological protection, waste mitigation, and conservation-oriented tourism management. Economic sustainability indicators were modified according to the parameter of Yanes et al. [11], whose community-based tourism policy assessment framework encompasses the constructs concerning employment, income generation, and entrepreneurial involvement. The sociocultural sustainability and heritage preservation items were modeled after Krittayaruangroj et al. [12] and Saltman and Abuamoud [13] which gave validated constructs of cultural identity, community participation, and heritage management. Everything was slightly contextualized to Petra and Wadi Rum. Content validity and factor-loading thresholds were assured by expert review and content and construct validity respectively. Site-specific insights were strengthened by stratified sampling across Petra and Wadi Rum, capturing perspectives from both domestic and international visitors. Moreover, the quantitative survey data with qualitative interviews will lead to a complete mixed-method design to enable convergence, triangulation, and deeper interpretation of sustainability trends in both locations. The study complied with ethical standards, participation in surveys and interviews was voluntary, informed consent was obtained, and no personal or identifiable information was collected.

3.4. Ethical considerations

The study complied with ethical standards: participation in surveys and interviews was voluntary, informed consent was obtained, and no personal or identifiable information was collected.

3.5. Data analysis plan

Statistical analysis of data involved a combination of descriptive and inferential statistical analysis. Descriptive statistics assisted in summarizing demographic data and determining general trends among the respondents. Inferential statistics, including regression analysis, assisted in hypotheses testing of the study and examining the relationship between sustainable tourism practice and its perceived impact. Moreover, a comparative

examination was conducted in order to gauge Petra and Wadi Rum separately and comparatively, allowing site-specific trends and shared issues of sustainability to be determined.

4. Results and discussion

4.1. Descriptive statistics

The descriptive statistics for survey respondents of Petra and Wadi Rum are presented in Table 1. It provides an overview of their demographic characteristics and level of awareness of sustainable tourism.

Table 1. Descriptive statistics table based on a survey respondent from Petra and Wadi Rum

Variable	Most frequent value	Frequency	Mean	Std. dev.	Min	Max	Median	Mode	Percentage
Age	-	-	34.30	6.06	25	45	34	34	-
Gender	Male	107	-	-	-	-	-	Male	50.00%
Nationality	Jordanian	107	-	-	-	-	-	Jordanian	50.00%
Education level	Bachelor	85	-	-	-	-	-	Bachelor	39.72%
Visit Purpose	Leisure	85	-	-	-	-	-	Leisure	39.72%
Awareness of sustainable tourism	Yes	128	-	-	-	-	-	Yes	59.81%

A summary of the demographic and perceptual profile of the survey participants who toured Petra and Wadi Rum is shown in Table 1. With a limited age range of 25 to 45 years, and an average participant age of 34.3 years, the sample appears to be dominated by young-to-middle-aged adults. The middle-aged range in this segment is also balanced, as both the mode and the median are 34.

There is a representation of equal sexes with half of the sample being male. This equality shows that men and women engage in the activities of the tourists in these destinations at an equal rate. Similarly, half of the respondents are Jordanians, which means that domestic tourist is as significant as foreign tourists. This has some consequences on how the locals relate to sustainable tourism projects. Approximately 40% of the participants had a bachelor's degree; the maximum level of education that the participants have been exposed to. This relatively high level of education can be attributed to the fact that more insight and awareness about matters of sustainability can be attributed. This is appropriate given the fact that 59.81% of the respondents were found to be familiar with sustainable tourism practices, which implies that the majority of respondents are exposed to or aware of green travel concepts. The most common purpose of visiting is recreation, reported by 39.72% of the sample. This is consistent with the recreational and heritage significance of Petra and Wadi Rum and provides support for the argument above that sustainable plans should be formulated in a way that minimizes negative recreational impacts while promoting responsible visitor behavior. When discussing the adoption and effectiveness of sustainable visiting behavior at large heritage sites in Jordan, these findings provide a picture of a relatively well-informed and environmentally aware tourist segment.

4.2. Findings and analysis

The impact of sustainable tourism development at Petra and Wadi Rum was analyzed by the regression analysis. It is the presentation of the key findings of the analysis of the study in four important dimensions, i.e. economic development, environmental sustainability, cultural heritage protection and overall perceived effect. The research focuses on establishing the level of effectiveness and how the common sustainability practices are perceived by the stakeholders based on the statistical relationship between the practices and the outcome variables. The findings will direct policy and practice in the tourism sector of Jordan by giving a vivid picture on where concrete enhancement points can be achieved and where additional focus is needed.

4.3. Regression diagnostics assumptions

All the necessary diagnostic tests were performed in order to make the regression analysis robust enough. The analysis of the residual plots proved that the conditions of linearity and homoscedasticity were met, and no apparent patterning was observed in the residual distributions. The interpretation of normality of the residuals was checked with the help of the histogram and the Shapiro-Wilk test which revealed that the residual values were normally distributed with acceptable values. The analysis of multicollinearity diagnostics indicated that variance inflation factor (VIF) values were less than 2.0 in all predictors, which proves that there are no multicollinearity issues. Moreover, all the standardized residuals were within the range of -3, and therefore, no influential outliers. All these diagnostics together indicate that the regression models represent the correct underlying statistical assumption and that the coefficients and significance levels given are sound and acceptable.

Table 2. Sustainable practices regression analysis of sustainable practices on overall perceived impact

Independent variable	Dependent variable	R ²	F (ANOVA)	B	S. E	Beta	t	Sig.
Constant	Perceived impact	0.27	F=67.24, p<0.001	2.88	0.22	—	13.09	0.000
Sustainable practices	Perceived impact			0.41	0.05	0.52	8.20	0.000

Regression analysis of the role of sustainable tourism activities on overall perceived role is presented in Table 2. Based on the analysis, there is a scaled beta of 0.52 and regression coefficient (B) of 0.41 with a positive, statistically significant relationship. The significance of the impact is 0.05 with t-value of 8.20 and p-value of 0.000. This means that the impact observed as a whole is greatly enhanced by the addition of sustainable tourism measures. The influence of this connection means that stakeholders and tourists alike value and recognize efforts in Petra and Wadi Rum to promote socially and environmentally friendly tourism practices. Thus, the null hypothesis (H_1) that no significant effect exists is rejected. These findings are consistent with global literature recognizing the role of sustainability in promoting tourist satisfaction and building destination image.

Table 3. Regression analysis of sustainable practices on environmental impact

Independent variable	Dependent variable	R ²	F (ANOVA)	B	S. E	Beta	t	Sig.
Constant	Environmental impact	0.22	F=40.06, p<0.001	3.45	0.28	—	12.32	0.000
Sustainable practices	Environmental impact			0.38	0.06	0.47	6.33	0.000

Table 3 shows how the environment has been affected by environmental sustainability measures. The values represent positive association of high strength, with beta = 0.47 and regression coefficient (B) = 0.38. The correlation is also significant with t = 6.33 and p = 0.000. These results indicate that eco-lodging, waste minimization and conservation projects are viable tourism projects that would help a lot in conservation of the ecosystems of Petra and Wadi Rum. The null hypothesis (H_1) is rejected, confirming that sustainability projects and initiatives are effective in curbing environmental degradation. This result is congruent with the literature on the significance of sustainable tourism as one of the ways to preserve vulnerable landscapes, such as deserts and historical sites.

Table 4. Regression analysis of sustainable practices on economic impact

Independent variable	Dependent variable	R ²	F (ANOVA)	B	S. E	Beta	t	Sig.
Constant	Economic impact	0.01	F=1.00, p=0.319	2.64	0.25	—	10.56	0.000
Sustainable practices	Economic impact			0.07	0.07	0.08	1.00	0.319

Table 4 illustrates the economic impact and sustainable practices test. The beta is 0.08 and regression coefficient (B) is 0.07. Outcome is not statistical and t = 1.00, p-value of 0.319. It is demonstrated that, although there are

economic gains in sustainable tourism, the responses are not expected to make a significant difference in the level of these gains. Other issues, like the unavailability of the market, bad funding, or restrictions of the regulations, can inspire their attitudes. On this account, the null hypothesis (H_2) cannot be rejected. This study discovers an unequal ratio of qualitative sustainability initiatives and quantitative economic value, which emphasizes the necessity of further specific skills of increased local work, entrepreneurship, and income by sustainable tourism. Moreover, interviews with local stakeholders revealed that while environmental initiatives were visible and well-supported, economic benefits were hindered by limited market access and insufficient investment in community enterprises. Similarly, cultural heritage preservation was constrained by weak community involvement in decision-making, with policies often prioritizing commercial tourism over cultural sustainability.

Table 5. Regression analysis of sustainable practices on cultural heritage preservation

Independent variable	Dependent variable	R ²	F (ANOVA)	B	S. E	Beta	t	Sig.
Constant	Cultural heritage preservation	0.00	F=0.03, p=0.867	2.88	0.23	—	12.52	0.000
Sustainable practices	Cultural heritage preservation			0.01	0.06	0.01	0.17	0.867

The effect of sustainable practices on the conservation of cultural heritage is put to test in Table 5 where the t-value = 0.17, p-value = 0.867 and the regression coefficient (B) = 0.01 and beta = 0.01. These do not imply the existence of a statistically significant relationship. The null hypothesis (H_3) is thus true. This implies that there is no assurance that the stakeholders understand the effect of the existing sustainable tourism policy, otherwise they are not addressing issues of cultural heritage as much as they ought to. It can imply a lack of planning in cultural conservation or insufficient community involvement in heritage management. It calls for better-aligned practices and participatory approaches that enable local communities to preserve their culture while also benefiting from tourism.

4.4. Qualitative information on interviews with stakeholders

Semi structured interviews of the local stakeholders such as site managers, tourism operators, community leaders and the government were conducted to further complement the quantitative analysis, by providing more contextual insights on the sustainability implementation in Petra and Wadi Rum. Three major themes emerged:

Theme 1: High Institutional attention to environmental initiatives.

Interviewees have also highlighted that environmental programs receive the greatest investment, monitoring, and visibility. Some things that were mentioned by stakeholders are better waste management, visitor routes, eco-friendly lodges, and conservation patrols in Wadi Rum and Petra. As several respondents pointed out, environmental practices are given high importance as they are more quantifiable and attract donor funding, contributing to the high measured environmental impact of sustainable tourism practices.

Theme 2: Low economic spillover to the local communities.

Although the leaders of the communities were aware of the importance of sustainable tourism, they had shown the concern that the economic gains are still held in the hands of the bigger tourism companies. Limited access to financing, poor market connections to local handicrafts, and lack of support of small businesses owned by Bedouin were among some of the barriers reported by several interviewees. This is in line with the non-significant statistical correlation between sustainable practices and economic impact that indicates that sustainability programs are yet to be incorporated into significant economic empowerment at the local level.

Theme 3: Cultural heritage activities are poorly developed and inclusive of less than they should be.

The majority of the respondents indicated that the cultural preservation programs are still very minimal when compared to those of the environment and in most cases do not involve the community. Traditional values, such as oral tradition, and local identity are not being systematically incorporated into the plans of developing

tourism. A single stakeholder of Wadi Rum, in response to the inquiry of what cultural programs do and do not do, said that they are symbolic and not transformative, which is mirrored by the quantitative finding that there is no significant impact of sustainable tourism initiatives on cultural heritage preservation. Interviewees explained this by commercial pressures, a lack of training and a lack of platforms to give voice to local voices in the culture decision making processes.

Theme 4: Petra and Wadi Rum differences in sustainability implementation.

Site-specific patterns were also seen in the data collected through interviews. The Petra stakeholders highlighted the problems of congestion, visitor numbers, and commercialization, while the Wadi Rum respondents highlighted the problems of the environmental context, land-use pressures, and Bedouin involvement. Even when the two sites were grouped together using quantitative data, the qualitative knowledge indicates that Petra has more problems in the management of cultural heritage, whereas Wadi Rum has better management of the environment by the local communities. These results emphasize the necessity of location specific sustainability measures.

4.5. Comparative observations: Petra and Wadi Rum

Although the quantitative analysis adopted a combined outcome of both locations, additional descriptive and qualitative analyses reveal that there are apparent site-specific differences in sustainability perceptions and implementation patterns.

4.6. Environmental sustainability

In terms of Wadi Rum, the respondents were more aware of and engaged with environmental programs than in Petra. The interviewees consistently emphasized the need to have good waste management systems, eco-camps, improved conservation controls, and community-based desert protection programs. Stakeholders at Petra, on the other hand, cited the lack of control in managing the large number of tourists and the related waste, especially during peak tourist seasons. These results are in accordance with the regression analysis, which shows that Wadi Rum demonstrates stronger environmental sustainability performance.

4.7. Economic impact

The benefits associated with both sites were economically based but the type of benefits was different. Petra had small tourism enterprises that competed with big commercial tourism providers and did not have the power to attract high spending foreign tourists. At the same time, the Bedouin camp owners in Wadi Rum reported the unstable stream of the visitors and absence of effective marketing assistance. These site level differences demonstrate the non-significant level of economic regression results, and here the structural constraint that influences each of the territories differently is accentuated.

4.8. Sociocultural and heritage preservation

In Petra, there were concerns raised by stakeholders regarding cultural pressures due to commercialization, the absence of local communities in heritage interpretation, and conflicts between conservation and tourism requirements. Stakeholders in Wadi Rum focused on making the tourism industry more closely connected to Bedouin culture, but they also acknowledged that cultural projects still take a back seat to ecological initiatives. The regression findings, which show no statistically significant effects on cultural sustainability, also support the idea that there are different manifestations of these challenges across the two locations.

4.9. Synthesis

Overall, Wadi Rum is more effective in terms of environmental management, whereas Petra has to deal with the challenges of cultural conservation and the level of commercial activity. The two sites have low payoffs in the sustainability programs. These comparative lessons help gain better insight into the way sustainability practices work in various heritage settings.

5. Discussion

The findings of this research have practical implications for understanding whether environmentally sustainable travel behavior is beneficial or not in both Petra and Wadi Rum. The findings of the regression analysis constitute a complicated scenario where we have more or less sustainability, which is resilient, yet others are

not so well established or explained to the stakeholders. It is evident that both the tourists and the stakeholders appreciate the role that sustainability activities play in improving the tourism experience as the correlation between the overall perceived impact and sustainable tourist behavior is statistically significant and negative (Table 2). One such piece of evidence is the confirmation of results at a global level, which show the role of sustainability in developing destination image, visitor satisfaction, and long-term sustainability. The advantage of such an approach is that people who travel to these destinations not only embrace but also engage in activities such as eco-lodging, recycling of waste, and volunteerism which coincides with the results of Abuamoud and Jawabreh et al. [29], [16].

The topicality of environmental stewardship towards nature-based and heritage tourism is also seen in the quantifiable effects of the sustainability efforts on the environmental results (Table 3). The results support the claim that the work done in the management of natural resources, protection of biodiversity, and reduction of waste is going in the correct direction in the ecologically dangerous regions such as Wadi Rum. This is consistent with the results of previous research that supports community-conservation designs and cumulative environmental policy, whereby the success of local action and policy in Jordan serves as a model in halting environmental degradation. This is consistent with Zhang et al. [14], Jawabreh et al. [16], and Shah et al. [31].

However, analysis also reveals considerable weaknesses in sociocultural and economic dimensions of sustainability. Specifically, the failure in finding a statistically significant relationship between economic gain and sustainable activities (Table 4) is reason to be concerned that current efforts are not being reflected in gain for the bottom line of local communities. Possible reasons such as -lack of market access, insufficient investment in business, or the absence of inclusive policy mechanisms can be blamed. Although community-based tourism can induce economic growth, its implementation in Wadi Rum and Petra will require further focused intervention, capacity building, and economic incentives to facilitate benefit sharing. The insights from Andersson et al. [32], Alqahtani et al. [33], Islam [34], and Samarh et al. [35] seem to be in alignment.

There are perhaps more troubling findings in relation to the outcomes for the preservation of cultural heritage (Table 5). These findings suggest deeper social and cultural dimensions of tourism practices, indicating that the sociocultural aspects of sustainable tourism remain under-recognized and, consequently, underinvested. This may suggest the existence of a policy problem gap in which the commercial motives or the lack of community participation in tourism practice outweigh any motifs that are concerned with preserving cultural heritage. This result highlights the importance of culturally sustaining tourism development and of planning for culturally sustaining tourism with local identity and, or tradition and inclusive governance. Without such planning efforts, cultural erosion and communal alienation remain risks. Whether or not environmentally sustainable traveling behavior is of any benefit in Petra and the Wadi Rum, the findings from the regression analyses tell a story about the lack of sustainability, which is resilient in parts, and in others is not well constituted, or sufficiently or sufficiently explained to stakeholders. Both tourists and stakeholders understand the importance of sustainability efforts as they improve the experience of tourists and sustain positive impacts. Evidence of this is the strong negative correlation pointed to in the survey (table 2). One other benefit is that travelers to such destinations actively participate in eco-friendly behaviors such as eco-lodging, trash recycling, and volunteering. This is also consistent with the results of Abuamoud and Jawabreh et al. [29], [16].

The concern for environmental stewardship with sustainability efforts in nature-based and cultural tourism is notable in the quantifiable environmental outcomes (table 3). This research supports the statement that the management of natural resources through waste reduction, protective maintenance on biodiversity, and holistic practices is positive in ecologically distressed areas such as Wadi Rum.

6. Conclusions

This study investigated the sociocultural, economic, and environmental impacts of sustainable tourism practices in Petra and Wadi Rum. The positive perception of sustainable tourism practices was noted, but the impact changes depend on the area of influence. Most noteworthy, though, was the discovery that the impacts of

sustainable tourism activities on the environment were strong, positive, and statistically significant. These results showcase the need for more green infrastructure, ecological conservation, and sustainable tourist management to maximize the sustainability potential of Jordan's top tourist destinations.

The absence of a visible contribution to economic growth, and consequently the economic and cultural sustainability gaps identified in the research, signify that current approaches may be overly focused and limited in their capacity to empower local people. Similarly, the limited impact of cultural heritage protection suggests that more inclusive and dynamic forms of participation relating to culture are required. These gaps, particularly the call for local entrepreneurial participation, are important in the integration of community consultation, cultural tourism, and the protection of cultural identity into tourism development and policy.

This research submits the following for consideration:

- Enhance community touristic practices: enhance community active involvement in tourism practices and planning to ensure equitable distribution of economic rewards and community pride.
- Help stakeholders meaningfully integrate heritage: assist in the formulation of stakeholder initiatives of meaningful and integrated management and interpretation of heritage in order to ensure benefit and avoid the commoditization of heritage.
- Build environmental monitoring and education: build on investments in environmental protection and promote awareness among tourists and tour operators in practicing environmentally sound tourism.
- Enhance the coordination and active policy implementation: ensure the sustained coordination of stakeholders and the active implementation of the tourism national policy, responsible accountability, financing, and stakeholder coordination.
- Promote domestic entrepreneurship and innovation: enhance training, financing, and market accessibility to domestically owned enterprises that meet the standards of sustainable tourism, in marginalized/ poor communities.
- Value inter-disciplinary integrations: work with NGOs, and internationally linked institutions, and provide integrated development of techniques, innovations, and international best practices for Jordan tourism stakeholders.
- Sustainable tourism is very promising in the case of Jordan's Petra and Wadi Rum. However, it remains to be accomplished using adaptive, inclusive, and culturally sensitive efforts.

To advance the success of sustainability, future research should explore longitudinal impacts, stakeholder relationships, and the contributions of digital technologies.

Declaration of competing interest

The authors declare that they have no known financial or non-financial competing interests in any material discussed in this paper.

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Informed consent

Informed consent for the publication of personal data in this article was obtained from the participant(s).

References

- [1] K. Lagos and Y. Wang, "International tourism and poverty alleviation: cross-country evidence using panel quantile fixed effects approach," *Journal of Travel Research*, vol. 62, no. 6, pp. 1347-1371, 2023, <https://doi.org/10.1177/00472875221119978>.
- [2] T. Haddad, "' We Have to Survive': An Ethnographic Field Study Of Tourism And The Bedouins In Wadi Rum, Jordan," University of Houston, Texas, 2023, <https://hdl.handle.net/10657/14985>.
- [3] C. Shekhar, "Sustainable tourism development: Balancing economic growth and environmental conservation," *Available at SSRN 4901174.*, 2024, <https://dx.doi.org/10.2139/ssrn.4901174>.
- [4] A. Sharma and P. Sodani, "Ethics in tourism: Responsibility toward balancing sustainability," in *In International Handbook of Skill, Education, Learning, and Research Development in Tourism and Hospitality*, Singapore: Springer Nature Singapore, 2024, https://doi.org/10.1007/978-981-97-4318-6_41, pp. 629-647.
- [5] P. Kołodziejczyk, M. Tarawneh, B. Abuhelaleh, M. Nowak and M. Wasilewski, "Natural and Anthropogenic Threats to Prehistoric Archaeological Sites in Southern Jordan: Comparison with Poland and a Call for the Exchange of Experiences," *Museology & Cultural Heritage/Muzeologia a Kulturne Dedicstvo*, vol. 13, no. 2, p. 79, 2025, <https://www.doi.org/10.46284/mkd.2025.13.2.5>.
- [6] A. Risfandini, "Sustainable tourism implementation in Indonesia: Emphasizing green tourism, community-based tourism, and local empowerment," *Barista: Jurnal Kajian Bahasa Dan Pariwisata*, vol. 11, no. 1, pp. 58-67, 2024, <https://doi.org/10.34013/barista.v11i1.1506>.
- [7] Q. B. Baloch, S. N. Shah, N. Iqbal, M. Sheeraz, M. Asadullah, S. Mahar and A. U. Khan, "Impact of tourism development upon environmental sustainability: a suggested framework for sustainable ecotourism," *Environmental Science and Pollution Research*, vol. 30, no. 3, pp. 5917-5930, 2023, <https://doi.org/10.1007/s11356-022-22496-w>.
- [8] H. Surya, H. Prabowo, M. Hamsal and B. Simatupang, "Current Trends in Sustainable Tourism Destinations Over the Last Decade: A Bibliometric Analysis," in *International Conference on Business Excellence (pp. 387-401)*, Springer, Cham., 2025, https://doi.org/10.1007/978-3-031-78179-7_23.
- [9] A. Ver Steeg, "Ecotourism and the Middle East: Lessons in development," *Dartmouth Undergraduate Journal of Politics, Economics and World Affairs*, vol. 1, no. 2, p. 6, 2022, <https://digitalcommons.dartmouth.edu/dujpew/vol1/iss2/6>.
- [10] E. Mahadeen, "Jordanian cinema: A burgeoning scene," in *Routledge Handbook on Arab Cinema*, Routledge, 2024, <https://doi.org/10.4324/9781003302025-9>, pp. 94-107.
- [11] A. Yanes, S. Zielinski, M. Diaz Cano and S. I. Kim, "Community-based tourism in developing countries: A framework for policy evaluation," *Sustainability*, vol. 11, no. 9, p. 2506, 2019, <https://doi.org/10.3390/su11092506>.
- [12] K. Krittayarungroj, S. Suriyankietkaew and P. Hallinger, "Research on sustainability in community-based tourism: a bibliometric review and future directions," *Asia Pacific Journal of Tourism Research*, vol. 28, no. 9, pp. 1031-1051, 2023, <https://doi.org/10.1080/10941665.2023.2276477>.
- [13] M. Saltman and I. Abuamoud, "The Sustainable Management of Cultural Heritage Sites: Tourism and the Politics of Archaeology at Petra," *Academic Journal of Interdisciplinary Studies*, vol. 9, no. 4, pp. 46-54, 2020, <https://doi.org/10.36941/ajis-2020-0060>.

-
- [14] Z. Zhang, K. Xiong and D. Huang, "Natural world heritage conservation and tourism: a review," *Heritage Science*, vol. 11, no. 1, p. 55, 2023, <https://doi.org/10.1186/s40494-023-00896-6>.
- [15] E. K. Alotaibi, I. A. Khanfar, B. Ismaeel and A. S. Shkeer, "Analyzing the influence of direct marketing strategies on consumer purchasing decisions," *Heritage and Sustainable Development*, vol. 7, no. 1, pp. 329-338, 2025, <https://doi.org/10.37868/hsd.v7i1.1133>.
- [16] O. Jawabreh, E. A. D. A. Fahmawee, A. Jahmani, R. Qaddhat, S. A. Alqader and M. Saleh, "Ecosystem restoration as a nature-based solution: A case study of Wadi Rum," *Geojournal of Tourism and Geosites*, vol. 6, no. 13, pp. 1430-1442, 2025, <https://doi.org/10.30892/gtg.61303-1513>.
- [17] I. G. B. R. Utama, I. N. Suardhana, I. G. Sutarya and N. P. D. Krismawintari, "Assessing the impacts of overtourism in Bali: Environmental, socio-cultural, and economic perspectives on sustainable tourism," *TourismSpectrum: Diversity & Dynamics*, vol. 1, no. 2, pp. 10-56578, 2024, <https://doi.org/10.56578/tsdd010202>.
- [18] B. Ismaeel, B. Y. Alkhalwaldeh and K. K. Alafi, "The role of marketing intelligence in improving the efficiency of the organization: An empirical study on Jordanian hypermarkets," *Journal of Intelligence Studies in Business*, vol. 13, no. 2, pp. 32-42, 2023, <https://doi.org/10.37380/jisib.v13i2.1082>.
- [19] S. Roberts, "Socio-cultural sustainability and small tourism businesses," *Tourism and Hospitality Research*, vol. 23, no. 3, pp. 298-311, 2023, <https://doi.org/10.1177/14673584221093537>.
- [20] Z. Ivancsóné Horváth, M. Kupi and E. Happ, "The role of tourism management for sustainable tourism development in nature reserves in Hungary," *GeoJournal of Tourism and Geosites*, vol. 49, no. 3, pp. 893-900, 2023, <http://doi.org/10.30892/gtg.49306-1090>.
- [21] R. El Shafaki, N. Mesbah, C. Maxim and A. M. Morrison, "Sustainable urban tourism in MENA countries," in *Handbook on Sustainable Urban Tourism*, 2024, <https://doi.org/10.4337/9781803926742.00047>, pp. 496-513.
- [22] L. Pilelienė, V. Grigaliūnaitė and Y. Bogoyavlenska, "A bibliometric review of innovations in sustainable tourism research: Current trends and future research agenda," *Sustainability*, vol. 16, no. 16, p. 7124, 2024, <https://doi.org/10.3390/su16167124>.
- [23] A. Thullah and S. A. Jalloh, "A Review of the Economic, Social and Environmental Impacts of Tourism Development," *American Journal of Theoretical and Applied Business*, vol. 7, no. 2, p. 39-46, 2021, <https://doi.org/10.11648/j.ajtab.20210702.12>.
- [24] G. S. Hijawi and B. Ismaeel, "The role of sales forces in the integration of marketing communication: an empirical study on the tourism sector in Jordan," *AAU Journal of Business and Law*, vol. 8, no. 2, 2024, <https://doi.org/10.51958/AAUJBL2024V8I2P8>.
- [25] K. K. Alafi, B. Ismaeel, M. N. Almarshad, M. A. Al-habash and R. Al-Aqrabawi, "Analysis of Competitive Intelligence in Retail Management in the Jordanian Market from the Consumer's Perspective," *Journal of Intelligence Studies in Business*, vol. 13, no. 3, pp. 24-38, 2023, <https://doi.org/10.37380/jisib.v13i3.1114>.
- [26] S. Tehseen, K. Y. Ong, S. M. Hossain and E. Andrews, "Sustainable Tourism: A Catalyst for the Green Economy," in *The Need for Sustainable Tourism in an Era of Global Climate Change: Pathway to a Greener Future* (pp. 53-67), Emerald Publishing Limited, 2024, <https://doi.org/10.1108/978-1-83608-668-020241009>.
-

-
- [27] Z. Ke and M. Mustafa, "Promoting Public Engagement in Urban Heritage Preservation through Participatory Art Case Studies of Practices and Approaches," *Archives of Design Research*, vol. 37, no. 5, pp. 221-243, 2024, <http://dx.doi.org/10.15187/adr.2024.11.37.5.221>.
- [28] J. A. Hubbart, "Harmonizing science and society: A change management approach to align scientific endeavors with societal needs," *Sustainability*, vol. 15, no. 21, p. 15233, 2023, <https://doi.org/10.3390/su152115233>.
- [29] I. N. Abuamoud, "Assessing Tourists' Willingness to Pay for Sustainable Tourism in Petra, a Contingent Valuation Study," *Nature Environment and Pollution Technology*, vol. 24, pp. 211-222, 2025, <https://doi.org/10.46488/NEPT.2025.v24iS1.015>.
- [30] D. Al-Halbouni, O. AlRabayah and L. Rüpke, "A vision on a UNESCO global geopark at the southeastern dead sea in Jordan—geosites and conceptual approach," *Land*, vol. 11, no. 4, p. 549, 2022, <https://doi.org/10.3390/land11040549>.
- [31] A. A. Shah, F. Waheed, N. Akbar and I. Abubakar, "Sustainable Development of Heritage Sites in the Middle East: Wadi Hanifah and Dana Biosphere Reserve," in *The Palgrave Handbook of Practical Sustainability* (pp. 113-133), Cham: Springer Nature, 2025, https://doi.org/10.1007/978-3-031-82857-7_7, pp. 113-133.
- [32] S. Andersson, G. Svensson, F. J. Molina-Castillo, C. Otero-Neira, J. Lindgren, N. P. Karlsson and H. Laurell, "Sustainable development—Direct and indirect effects between economic, social, and environmental dimensions in business practices," *Corporate Social Responsibility and Environmental Management*, vol. 29, no. 5, pp. 1158-1172, 2022, <https://doi.org/10.1002/csr.2261>.
- [33] F. M. Alqahtani, M. Abas, M. Alkahtani, M. Hayat and A. Farrukh, "Enhancing sustainable safety practices in construction: Insights from cultural and socio-economic analysis," *Sustainability*, vol. 16, no. 12, p. 5103, 2024, <https://doi.org/10.3390/su16125103>.
- [34] H. Islam, "Nexus of economic, social, and environmental factors on sustainable development goals: The moderating role of technological advancement and green innovation," *Innovation and Green Development*, vol. 4, no. 1, p. 100183, 2025, <https://doi.org/10.1016/j.igd.2024.100183>.
- [35] T. Samarah, A. Hindieh, M. Daoud and M. Almiani, "Intelligent Voice Search Strategies for Digital Marketing Transformation," *International Journal of Advances in Soft Computing & Its Applications*, vol. 17, no. 1, p. 338, 2025, <https://doi.org/10.15849/IJASCA.250330.18>.