Assessment of recreational value of national Chambal sanctuary: application of individual travel cost model

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Abstract

Purpose – This study aims to assess the recreational value of the National Chambal Sanctuary highlighting the potential benefits of conservation and the need for sustainable practices.

Design/methodology/approach – This study uses the Individual Travel Cost Method to evaluate the expenses of individuals visiting the National Chambal Sanctuary.

Findings – The study reveals that the National Chambal Sanctuary has a significant recreational value, with an average visitor value of INR 35,335.69 or USD 434 and an annual value of INR 132,473,501.81 or approximately USD 1.62m, indicating substantial economic contribution.

Research limitations/implications – The study's limitations may stem from data collection constraints, visitor reporting biases or other factors affecting estimates' accuracy. Future research could explore socio-economic factors or factors affecting low tourist inflow in India's protected areas (PAs).

Practical implications – This study suggests raising entrance fees for the National Chambal Sanctuary to ensure financial sustainability, based on its high recreational value and average consumer surplus. This has practical implications for policymakers, conservationists and the tourism industry.

Social implications – The study underscores the significance of protecting PAs like the National Chambal Sanctuary, suggesting that public attitudes towards biodiversity conservation can be influenced by highlighting its economic and recreational value and promoting awareness of its significance.

Originality/value – The study evaluates the recreational value of a wildlife sanctuary in India, offering insights into conservation's economic benefits and sustainable practices and promoting further research.

Keywords Economic valuation, Individual travel cost method, Recreational value, Consumer surplus, National Chambal Sanctuary

Paper type Research paper

1. Introduction

Protected areas (PAs) are well-known for their ability to conserve ecosystems, biodiversity and natural resources (Baral *et al.*, 2008). PAs are projected to contribute to poverty reduction and sustainable development by promoting sustainable tourist development (Plummer and Fennell, 2009; Andam *et al.*, 2010). PAs contribute to biodiversity conservation on their property and serve as an asset in the long run. Indeed, it is frequently the most cost-effective and environmentally friendly way to use property. PAs must be self-sufficient to conserve animals, create ecotourism and manage ecosystems, with impoverished countries experiencing harsher socioeconomic conditions due to a lack of finance, staff and local engagement (Yadav *et al.*, 2018).

Participatory forest management requires a profound understanding and application of sustainable management principles and practices at the local scale (Green and Lund, 2015). In addition to this, the adverse consequences of conservation policies implemented by PAs towards local inhabitants create an unfavourable and precarious environment for PA officials and the neighbouring community at large, as conflicts of interest arise (Dourojeanni, 2002; Baral *et al.*, 2008). In sophisticated nations, economic valuation studies of ecosystem services are being conducted extensively. Developing countries have a dearth of valuation studies, despite their possession of a substantial portion of ecological resources on a global scale (Hadker *et al.*, 1997). De Groot (2006) stated that economic valuations were useful for natural resource accounting, development planning and assessment. It facilitates the evaluation of the economic impact and forecasts the viability of various government initiatives through the implementation of cost-benefit analyses (Hanley and Spash, 1993). From an operational standpoint, Pigou, a pioneer in welfare economics, suggests that economic valuation be based on monetary values (Hicks, 1939; Pigou, 1951). Economic valuation assesses intangible products and services by establishing a fair market value via the equilibrium between supply and demand. As the absence of ownership renders price determination impossible for public commodities, scarcity generates value (Mitchell and Carson, 1989). Therefore, preserving the long-term supply of these natural resources is contingent upon their value.

There is little research on the economic assessment of PAs in developing nations, even though much more is needed. In this study, the recreational value of the National Chambal Sanctuary (hereinafter referred to as the Sanctuary) was measured using the individual travel cost approach. Various PAs, such as the Sanctuary, are incredibly valuable, yet their value is not appreciated. The undervaluation of ecosystems results in non-conservation land uses (Dixon and Sherman, 1991). The economic value of such PAs can bridge a significant gap, allowing policymakers and citizens to make more informed decisions about valuable natural assets (Sinclair *et al.*, 2022). Despite various international accords and commitments, global biodiversity is quickly decreasing (Pascual *et al.*, 2010). Continuous biodiversity loss impairs natural ecosystem functioning, limiting the ability to deliver ecosystem goods and services to present and future generations (Change, 2001). As a result, sustainable development is now widely seen as important. Regardless, conventional welfare activities fail to consider environmental factors when assessing Indigenous welfare. Environmental deterioration is likely to worsen, causing climate change, global warming and ozone layer depletion (Homer-Dixon, 1991). As a result, it is proposed that biodiversity and ecosystem services be viewed as finite resources rather than free goods (Butchart *et al.*, 2010). The value of biodiversity and its associated services, as well as the cost of harm or degradation, must be properly appraised (Costanza *et al.*, 1997; Blignaut and Moolman, 2006).

Although the importance of ecosystems to human society is multifaceted (ecological, socio-cultural and economic), expressing the value of ecosystem services in monetary units

is a critical tool for raising awareness and communicating the (relative) importance of ecosystems and biodiversity to policymakers (De Groot *et al.*, 2012). Monetary value-related evidence of such natural resources enables optimal use of such rare resources by correctly identifying needed conservation and refurbishment at the lowest cost, providing economic advantages (Crossman *et al.*, 2013). Furthermore, monetary valuation is useful in establishing compensation payments for the loss of ecological services (Bryan *et al.*, 2011; Payne and Sand, 2011).

The Sanctuary is thought to be a unique and endemic location among the most vital and significant habitats where various globally endangered flora and wildlife still exist (Nair, 2017). The Sanctuary in India is home to a varied diversity of crocodilians, turtles and birds, including the critically endangered gharial. Despite efforts to maintain and manage its resources, stakeholders continue to undervalue the Sanctuary. Increased water abstraction and diversion, unsustainable groundwater usage and a larger water footprint all contribute to pollution and environmental deterioration. The refuge faces threats such as land-use changes, sand mining, poaching and indiscriminate fishing. To conserve biodiversity while also addressing environmental degradation, global warming and climate change, effective management and stakeholder support are required.

The decline of endangered species poses a threat to the National Chambal Sanctuary, mandating sustainable development and balancing extraction for sustainable usage despite legislative restrictions. The economic worth of ecological resources is critical in preventing environmental deterioration, and PAs such as national parks and sanctuaries are set up to safeguard natural resources and biodiversity (Bharali and Mazumder, 2012). Local people are impacted by the government's conservation efforts in terms of displacement caused using the area's natural resources. As a result, "sustainable tourism" has been promoted within protected regions to mitigate the detrimental effects of conservation on local people. According to Yadav *et al.* (2016), sustainable tourism has not met the Sanctuary's expectations. The Sanctuary, despite its tourism potential, presents considerable issues due to poor management and a lack of knowledge, demanding policy adjustments. Based on the above-mentioned discussion, the following research questions can be raised to be answered throughout this study.

- *RQ1.* To what extent has ecotourism effectively contributed to the conservation efforts of the National Chambal Sanctuary?

- *RQ2.* Why is it necessary to do travel cost valuation analysis and how does visitors' opinion of the Sanctuary's recreational value affect conservation efforts?

- *RQ3.* How may recreational value assessment inform Sanctuary management and sustainability policy?

Based on the research questions, the following objectives have been framed for the study:
- To assess the recreational value of the Sanctuary such as birdwatching, wildlife observation, sailing and photography.
- To assess the conservation implications of recreational activities, including ecotourism's potential to preserve habitat and promote sustainable development and emphasise the importance of sustainable management in balancing recreation and conservation goals to inform decision-making and policymaking.

The remaining manuscript is organised in the following manner to fulfil the objectives of this study. The second section presents a review of the literature on trip cost method-based

investigations. The Sanctuary's geographical area is addressed in Section 3. The methodological approach, which includes valuation methodologies and the individual travel cost method (ITCM), is discussed in Section 4. Section 5 summarises the study's findings about the Sanctuary's recreational value. Section 6 summarises the conclusion, policy implications, and future work of this study.

2. Literature review

The literature review explores recreational valuation studies in national parks, focusing on the economic value and impact of recreational activities. The travel cost method (TCM) is used to estimate recreational value based on tourists' expenditure on visiting sites and other socio-economic variables. TCM uses questionnaires to gather information on visitors' residence, place, age, marital status and monthly income. The demand function generates demand for natural resources and services, with three essential aspects: order, quantity and substitute sites. Understanding these aspects is crucial for valuing natural resources and their recreational services. Economic value is more significant than market value, and TCM is used to estimate recreational value. The valuation of natural resources and their recreational services is important for understanding their worth. In India, national parks have been valued using travel cost and contingent valuation methods (Yadav and Sahu, 2015). The US National Service recognised the need for economic valuation of national parks in 1947, which was later used to evaluate environmental goods in different fields. Hotelling introduced the concept in 1947 to estimate recreational value (Hotelling, 1949; Alvarez and Larkin, 2010). The TCM was suggested to estimate the recreational value of visited sites based on the travel cost of tourists (Prewitt, 1949). Empirical models have been developed using TCM.

Authors (Manoharan, 1996; Maharana *et al.*, 2000; Himayatullah and Siddiqui, 2003) used travel cost method (TCM) and contingent value to assess the recreational advantages of PAs. By using these methods, they calculated consumer surpluses (CSs) and annual recreational values, yielding vital insights into the economic importance of natural reserves. The results emphasised the need to conserve these regions for both local and national tourists, with estimated worth ranging from Rs. 14.79m to Rs. 209m. Alpízar (2006) proposed the use of pricing mechanisms that would be most effective in maximising welfare and generating income for recreational activities in Costa Rica. Similarly, Bülow and Lundgren (2007) used the use of the TCM to calculate the recreational worth of Periyar National Park in India, uncovering its significant economic impact of US$15bn. These studies provide insight into the economic justification for park fees and the possibility of increasing revenue while maintaining sustainable management practices.

Navarro *et al.* (2008) and Chaudhry and Tewari (2008) conducted studies that evaluated the recreational advantages of national parks and urban gardens by using TCMs. These studies emphasised the need for effective park administration. Gera *et al.* (2008) highlighted the importance of establishing suitable pricing systems for the upkeep of Valley of Flowers National Park in India. Their evaluations yielded estimated values ranging from Rs 5,88,332 to Rs 55,41,834. These findings emphasised the significance of strategic pricing and revenue allocation for successful conservation efforts. Bernard *et al.* (2009) and Dewanta (2010) used survey-based techniques to assess the monetary worth of ecological amenities and recreational advantages, uncovering the diverse value of PAs that extend beyond mere recreational activities. Mendes and Proença (2011) and De and Devi (2011) conducted a comparative analysis of several valuation methodologies, revealing discrepancies in estimations and emphasising the need for methodological concerns for evaluating recreational value. Bharali and Mazumder (2012) proposed the most effective cost levels for park admission, whereas Twerefou and Ababio (2012) and Ankomah and Adu (2015)

investigated the elements that impact visitor patterns and the economic worth of parks in various settings. Birol and Karousakis (2016) conducted a meta-analysis that focused on the significance of wetland restoration projects in offering recreational advantages. They highlighted the need to consider parameters such as size, water quality and biodiversity when determining the recreational value of these projects.

Kays et al. (2017) found that controlled hunting and no consumptive recreational activities impact animal distribution in PAs in the eastern US. Habitat variables, forest extent and habitation density were more influential than recreation. The study emphasises sustainable management and adaptive measures for biodiversity conservation. Mayer and Woltering (2018) evaluated recreational services in 15 German national parks using the zonal TCM. The findings show that they contribute significantly to German society, with a lower-limit CS of EUR 385.3–621.8 million and an upper-limit value of EUR 1.690–2.751 billion. When studying the recreational worth of natural parks and protected places, it is crucial to go beyond only considering monetary considerations and instead comprehend the fundamental variables that influence visitor behaviour and preferences. Liu et al. (2019) examined the factors that influence trips to Taiwan's National Forest Park for recreational purposes. They used the TCM and a zero-truncated negative binomial regression model for their analysis. Their research uncovered complex connections among travel expenditures, visitor characteristics and the desire for leisure pursuits.

Amirnejad et al. (2020) used contingent value and TCMs to evaluate the recreational worth and willingness to pay for Bamou National Park. Their research highlighted the economic relevance of leisure activities in the park, emphasising the crucial role of sustainable management. Bigirwa et al. (2021) assessed the economic worth of recreational resources in Nyerere National Park, emphasising significant CSs and annual values of recreation use. The results underscore the crucial importance of safeguarding and prudently overseeing park resources to maintain economic advantages. Fajardo et al. (2022) used both revealed and stated preference techniques to ascertain the recreational advantages and ideal entry fees for eco-tourism sites within Bataan Natural Park. Their study emphasised the significance of maintaining a balance between CS and establishment expenses to achieve sustainable management of ecotourism. In addition, Cowell et al. (2020) and Breiby et al. (2022) conducted several studies that supported the implementation of comprehensive strategies for managing PAs. These strategies should incorporate social, economic and environmental factors. In addition, spatial recreational models, as exemplified by Dick et al. (2022) in Cairngorm National Park, provide useful insights into the recreational worth and management ramifications for PAs. Therefore, although monetary values are significant measurements, comprehending the wider context and consequences of recreational activities is essential for efficient park administration and sustainability.

Merciu et al. (2023) applied TCM to analyse the values associated with cultural heritage in Municipality of Bucharest and found that the demand for a cultural heritage site is inversely related to the travel costs and distance. The authors also highlighted the importance of conservation of such sites which are the symbols of socioeconomic and cultural dynamics. Determining the value of national parks is very important for calculating a country's national income. National parks provide social benefits and contribute to the economy through recreational and tourism activities. This economic value should be considered in development policies and the park should be protected in line with environmental protection policies for the benefit of society. In an interesting study, Jones et al. (2024) examined the attitudes and willingness of Japanese visitors to pay for a new conservation donation in Aso Kuju National Park. The findings suggest that most visitors would be willing to donate JPY 500 for the conservation in the PAs indicating the higher value of its ecosystem services. The

study suggests that implementing a new conservation donation system could help national parks like Aso Kuju generate sustainable funding. It has been found in a study conducted in China's 637 PAs that human interference in PA management enhances the ecosystem services that indirectly promote the national income (Yu *et al.*, 2024).

Loomis *et al.* (2024) examined the importance of valuing national parks based on their income contribution using the hedonic price method. Houseowners near national parks receive ecosystem service advantages that affect property values, according to the study. The survey found a 9.8% price rise for residential homes within 2 km of national parks. Due to their natural functions, these parks may increase property value. This information aids legislators and park administrators in national park and PA expansion decisions. It can also help local governments resolve conflicts and boost the number of stakeholders, including the real estate sector, who support national park conservation as natural entities.

Recreational activities in PAs, such as hiking, camping, wildlife viewing and fishing, contribute significantly to visitor spending, job creation, income generation and tax revenue. However, these studies face challenges like data limitations and stakeholder considerations. Despite the extensive literature on the assessment of recreational value in national parks, there is a lack of research specifically focusing on the assessment of recreational value of sanctuary. This research gap highlights the need for a study that specifically examines the economic value and impact of recreational activities in the National Chambal Sanctuary, using appropriate valuation methods such as the TCM or contingent valuation method. Such a study would provide valuable insights into the recreational value of the sanctuary and contribute to its sustainable management and conservation.

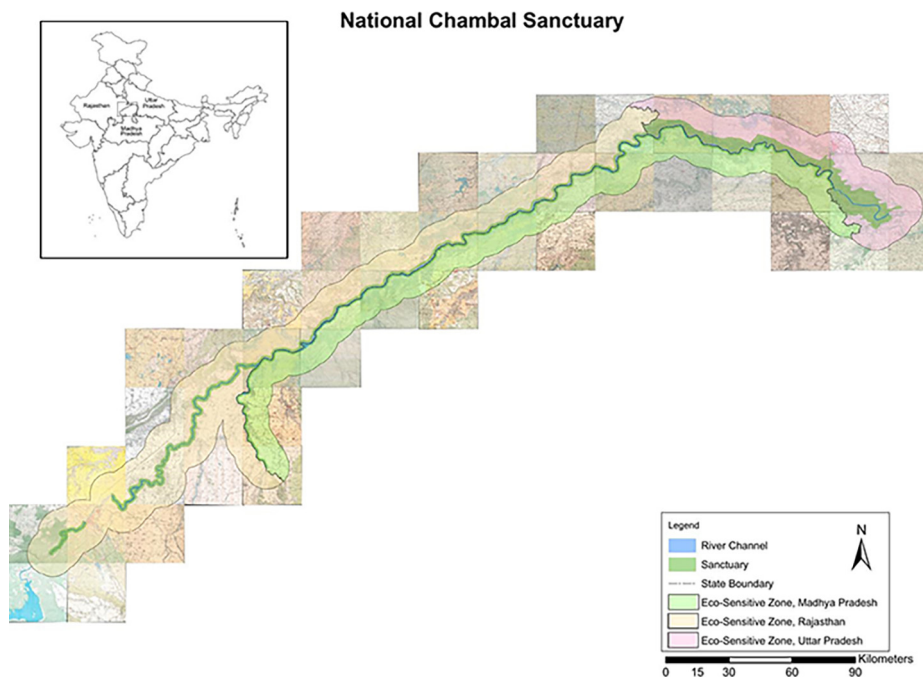### 3. The geographical area of the national Chambal sanctuary

According to the Wildlife Institute of India, there are 987 PAs in India, which comprise 106 national parks, 564 wildlife sanctuaries, 99 conservation reserves and 218 community reserves (see Table 1). These PAs extend over 173,053.69 sq. km. and cover 5.26% of the total geographical area of India. PAs have supported protecting a significant part of India's biodiversity. The present study deals with the economic valuation of the Sanctuary to measure recreational benefits using the ITCM.

The Sanctuary is a tristate PA among wildlife sanctuaries based on the Chambal River of India (see Figure 1). Lying between 24 55' and 26 50' N, 75 34' and 79 18'E, it spreads in Madhya Pradesh, Rajasthan and merges in the Yamuna River, Uttar Pradesh becoming a part of the Ganga drainage system. On average, the Chambal River is 400 m wide and 26 m deep (Hussain, 2013). A 600 km-broad area of the Chambal River, from Jawahar Sagar Dam in Rajasthan to Pachnada in Uttar Pradesh, has been confined and conserved as the National Chambal Sanctuary (Hussain, 2013). Human-wildlife conflict, sand mining, high population growth, illegal fishing and poaching pose many problems in the Sanctuary (Kumar, 2010).

Table 1. Protected areas of India

Types of PAs	No. of PAs	Total area of P.A.s (km^2)	Coverage percentage of country
National parks	106	44,372.42	1.35
Wildlife sanctuaries	564	1,22,509.33	3.73
Conservation reserves	99	4,726.24	0.14
Community reserves	218	1,445.71	0.04
Protected areas	987	173,053.7	5.26

Source: Wildlife Institute of India (2021)

National Chambal Sanctuary

Legend
- River Channel
- Sanctuary
- State Boundary
- Eco-Sensitive Zone, Madhya Pradesh
- Eco-Sensitive Zone, Rajasthan
- Eco-Sensitive Zone, Uttar Pradesh

N

Kilometers
0   15   30   60   90

Source: NCS departments

Figure 1. Geographical location of the National Chambal Sanctuary

These issues present additional hurdles for managing tourism in the Sanctuary, as well as maintaining the ecosystem and environmental conservation.

The Chambal River Sanctuary, located in three states, faces challenges in joint management due to local pressure on the river water. This overuse negatively impacts wildlife and biodiversity, including endangered species like turtles, gharial, Gangetic dolphin and Indian skimmer. Due to poor management, inadequate transportation options and a lack of attractive features, The Sanctuary receives a low number of tourists. However, the Gharial Conservation Centre in Madhya Pradesh supports gharials by collecting eggs from the Sanctuary and nurturing hatchlings. Different entry fees and boating rates exist in different regions of the tristate. The Sanctuary was established under the Wildlife Protection Act in 1972 by Uttar Pradesh, followed by Madhya Pradesh and Rajasthan. It serves as a crucial habitat for various endangered species. The details of tourist inflow in the Sanctuary for 2010–11 to 2020–21 years are given in Table 2.

It should be noted that the number of tourists visiting the Sanctuary has been steadily decreasing over the years. This decline can be attributed to factors such as inadequate administration and information for tourists, insufficient transit options and a lack of security. Additionally, it has been noted that individuals frequently enter the Chambal region without previous knowledge or tickets. This is because the Sanctuary is situated along the Chambal River, which poses significant challenges for the management authorities in Uttar Pradesh,

Table 2. Tourist's visit to National Chambal Sanctuary

| Year | Tourists visit to tri-states of the Sanctuary | | |
	Uttar Pradesh	Madhya Pradesh	Rajasthan
2010–11	626	4,140	
2011–12	750	1,938	–
2012–13	1,168	3,528	–
2013–14	1,069	2,680	–
2014–15	1,258	2,861	225
2015–16	1,421	2,640	236
2016–17	877	1,240	259
2017–18	1,490	1,191	242
2018–19	1,122	1,467	279
2019–20	1,803	1,035	96
2020–21	159	317	409

Source: National Chambal Sanctuary Departments

Madhya Pradesh and Rajasthan. However, there has been a significant decrease in the number of tourists since the start of the 2019–20 period, primarily because of the COVID-19 pandemic. It is anticipated that this loss will be reversed in the upcoming years.

4. Research design

This study uses the ITCM to assess the recreational value of the Sanctuary. TCM is extensively used to estimate recreational value from consumer behaviour in the associated market under non-market valuation (Smith, 1993). According to this method, there is a weak complementary between a recreational site and consumer expenses (Fleming and Cook, 2008). For example, the worth of a recreation facility is determined by the marginal utility of visitation. If consumption expenses are zero, visitation's marginal utility is also zero. As a result, the recreational location can only be valued when consumption expenditures are positive (Hanley and Spash, 1993).

There are two types of TCMs: Individual and Zonal. The dependent variable in the ITCM is the number of visits per year or tourist season to the recreational facility. The zonal travel cost technique (ZTCM), on the other hand, uses the population of a certain region or zone as the dependent variable rather than the number of visits. This study investigated all types of tourists to determine the recreational value from a broader perspective. As a result, the ITCM has been adopted. Few investigations have been undertaken that are relevant and consistent with the findings (Siderelis and Moore, 1995; Whitten and Bennett, 2002; Prayaga *et al.*, 2006). While investigating the impact of time and opportunity costs in a study, it was determined that including time costs would be unsuitable in trip cost-based valuation studies (Beal, 1995).

This study uses ITCM and a count data model to assess an individual's recreational demand functions, with the number of tourist visits to recreational sites serving as a substitute for travel costs. The ITCM is superior to the zonal cost method. Furthermore, ZTCM is statistically inefficient because it combines data from multiple observations into a limited number of zonal observations (Georgiou *et al.*, 1997). The ITCM is used in the present study to calculate the number of visits (V), which is a function of travel cost (TC), visitor monthly income (Y), distance (DT), employment, education, age, gender, nationality, substitute and Sanctuary quality. The independent variables used in this model were selected from research (Menendez-Carbo *et al.*, 2020; Kheyri *et al.*, 2020; Merciu *et al.*, 2023;

Lamhamedi *et al.,* 2021; Alessandro *et al.,* 2023) published using TCM for economic valuation and discussion with valuation experts.

The travel costs incurred by tourists to recreational sites include fees paid at hotels and entry fees delivered to the site as a proxy for the efficient Price for coming to areas, such as national parks and sanctuaries are being used for ITCMs. As suggested by Bülow and Lundgren's (2007), Structured questionnaire and interviews were used to gather required data. The following econometric model has been used to find out the recreational value of Sanctuary in monetary terms:

$$V = f(TC, Y, DT, EDU, AGE, EMP, GEN, SUB, ONCS, NATION) \qquad (1)$$

$$V = \beta_0 + \beta_1 TC + \beta_2 Y + \beta_3 DT + \beta_4 EDU + \beta_5 AGE + \beta_6 EMP + \beta_7 GEN + \beta_8 SUB$$
$$+ \beta_9 QNCS + \beta_{10} NATION + \varepsilon \qquad (2)$$

Dependent variable:

V = number of visits to the recreational site.

Independent variables:

TC	= travel cost of the trip;
Y	= tourist's monthly household income in Indian rupees;
DT	= distance travelled to reach sanctuary (in Kilometres);
EDU	= education of the tourists in the years;
AGE	= age of the tourists in the years;
EMP	= employment status of tourist; 1 for employed and 0 for otherwise
GEN	= gender of tourists; 1 for male and 0 for otherwise
SUB	= substitute site: 1 if the tourist knows another substitute site and 0 for otherwise
QNCS	= the quality of the sanctuary; 1 if tourist's perception of the site's recreational facilities is good and 0 for otherwise
NATION	= Nationality of tourists; 1 for foreign tourists and 0 for an Indian tourist; and
ϵ	= random error term

According to Garrod and Willis (1999), individual average CS can be estimated in equation (2), as given earlier. The CS per trip per person can be calculated as the negative inverse of the coefficient of the travel cost variable (Zhang *et al.,* 2015) from Table 4:

$$CS = -\frac{1}{\beta_1} \qquad (3)$$

where β_1 is the parameter estimate for the travel cost variable (Creel and Loomis, 1990; Pokki *et al.,* 2020). The approximate standard error for the CS can be derived from second-order Taylor series approximation (Englin and Shonkwiler, 1995).

When the population size is unknown, the sample size in a study area is established using the Cochran (1963) formula, which is as follows:

$$n = \frac{Z^2 \times p \times q}{e^2}$$

where:

n = sample size;

Z = value of the standard variate at a given confidence level; and

e = margin error (precision).

The sample size for the study is determined by taking $Z = 1.96$ (at 95% confidence level), $p = 50\% = 0.5$, $q = (1-p) = 0.5$ and $e = 5\% = 0.05$. The confidence intervals 90%, 95% and 99% are frequently used in social science research, whereas 95% confidence intervals are more frequently used in the literature. The literature generally assumes that 50% of the sample proportion is used to account for the maximum amount of population variability in cases when the population is unknown (Israel, 2016). The number of mistakes resulting from random sampling is referred to as margin error. A wider margin of error indicates a decreased possibility of relying on survey results, as the results' ability to accurately reflect a community may be deemed less certain. Many researchers set the margin error as 5%.

By entering these values into the formula mentioned above with confidence interval of 95%:

$$n = \frac{(1.96^2) \times 0.5 \times 0.5}{(0.05^2)} = 384.16$$

Therefore, 400 responses are the rounded result for the sample size.

In the present study, primary data were collected from the tourists to the Sanctuary through a questionnaire survey. The questionnaire consists of some basic questions about the socio-economic profile of visitors, total travel cost and distance from the Sanctuary to the visitor's residence. Responses were collected from visitors visiting the Sanctuary and its recreational spots and having a boating experience there. The surveys were conducted in Morena, Madhya Pradesh and the National Chambal Sanctuary project in the Bah Range of Agra, Uttar Pradesh.

A survey was done among 500 visitors using simple random sampling at various time intervals between January 2014 and June 2014 to obtain a representative sample collection. Recent research has revealed that the number of tourists visiting Madhya Pradesh exceeds the number of tourists visiting Uttar Pradesh. Out of a total of 500 surveys, only 431 were completed in their whole and subsequently used for data analysis, which is higher side of minimum number of responses required for a TCM-based study.

5. Results and Discussion

This section provides an overview of the survey and the findings derived from the data analysis. The study consisted of 431 participants who had visited the Sanctuary during January to June 2014. It was reported that, 137 (31.8%) participants were female while 294 (68.2%) were male. Out of the participants, 240 individuals (55.7%) were domestic tourists, whereas 191 individuals (44.3%) were foreigners. It is important to mention that just 42.0% (181) of the participants were aware the Sanctuary, whereas 58.0% (250) were unaware. Concerning the quality of the facilities and scenic beauty of Sanctuary, 12.7% (55) of the tourists conveyed discontentment with the facilities and services, whereas 87.2% (376) expressed contentment. The statistical characteristics of the variables used in the regression model are presented in Table 3.

Further, the Negative Binomial Model is used to estimate the CS in the following model. The results can be found in Table 4. The model is a statistical technique used to calculate the CS, which represents the difference between the aggregate amount that customers are willing to spend on a product or service and the actual price they end up paying. The findings of this model are displayed in Table 4, which presents details regarding the estimated coefficients, standard errors and statistical significance of the variables used in the model. These results are valuable for assessing the efficacy of pricing strategies and for making well-informed judgments.

The result from the regression analysis in Table 4 reveals that only three variables, travel cost, distance and nationality, are significant out of ten independent variables. Significance in the chi-square implies that the model is a good fit. As per our expectation, the independent

Table 3. Descriptive statistics

Variables	Mean	SD	Min.	Max.
Number of visits (per Year)	1.510	0.759	1	5
Travel cost (Rs)	9483.251	5207.398	500	19963
Income (Rs)	177029.400	192418.200	5,000	1,240,000
Distance (Km)	299.181	353.485	2	1,900
Education in years	16.135	2.266	8	22
Age (years)	46.392	14.479	18	78

Source: Authors' own work

Table 4. Estimated results from negative binomial regression model

Independent variable	Coefficient	SE	Z-Statistics	p-value
C	0.81006	0.367042	2.21	0.027
TC***	−0.0000283	9.43E-06	−3.01	0.003
Y	−2.64E-07	3.63E-07	−0.73	0.466
DT*	−0.0002629	0.0001497	−1.76	0.079
EDU	0.0005583	0.0170957	0.03	0.974
Age	−0.0036007	0.0032902	−1.09	0.274
EMP	−0.0398115	0.1110355	−0.36	0.72
GEN	0.0647432	0.0930547	0.7	0.487
SUB	−0.0046697	0.0861867	−0.05	0.957
QNCS	0.21799	0.1432909	1.52	0.128
NATION*	−0.2464055	0.1515932	−1.63	0.104
Number of obs	431			
LR chi^2(10)	81.27			
Prob > chi^2	0.0000			
[1]Pseudo R^2	0.0723			
Log-likelihood	−521.64098			

Notes: ***, ** and *represent 1, 5 and 10% levels of significance, respectively
Source: Authors' own work

variables, such as travel cost, distance and nationality, have a negative effect on the dependent variable, i.e. the number of visits to the site. The following model has been used for the regression analysis:

$$lV = 0.81006 - 0.0000283TC - 2.64e^{-07}Y - 0.0002629DT + 0.0005583EDU$$
$$- 0.0036007AGE - 0.0398115EMP + 0.0647432GEN - 0.00466697SUB \quad (4)$$
$$+ 0.21799QNCS - 0.2464055NATION$$

Lower travel costs lead to more visits, with each unit decreasing leading to a 0.0000283 increase in visits. Tourists' monthly household income (Y): Increased income leads to a decline in visits by 2.64×10^{-7} visits per unit increase. Longer distances result in fewer visits, with each unit increasing in distance resulting in a loss of 0.0002629 visits. Higher tourism education (EDU) is linked to increased visits, with each unit increase resulting in 0.0005583 visits. Older tourists tend to visit less, with each unit increase in age leading to a 0.0036007 drop in visits. Employed tourists had a lower visit rate than unemployed tourists

(EMP = 1), resulting in a drop of 0.0398115 visits. Male tourists tend to visit more than female tourists, with a 0.0647432 increase in visits due to gender (GEn = 1). Having awareness of another alternative site leads to fewer visits, with a loss of 0.00466697 visits (SUB = 1). Quality of Sanctuary (QNCS): Good perception of the sanctuary's recreational facilities leads to increased visitors, with a 0.21799 increase in visits (QNCS = 1). Nationality (NATION): Foreign tourists visit fewer than Indian tourists, with a loss of 0.2464055 visits (NATIOn = 1). These interpretations show how each independent variable affects site visitors while holding all other factors constant.

It can also be seen in Table 4 that Education (EDU), Gender (GEN) and Quality of Sanctuary (QNCS) has positive correlation with number of visits to National Chambal Sanctuary. While applying the β_1 values in equation (3), we get the value of average CS:

$$CS = -\frac{1}{-0.0000283}$$
$$= 35,335.69$$

Aggregated consumer surplus = Average Consumer surplus × Total number of visitors:

$$= 35,335.69 \times 3,749$$
$$= 132,473,501.81$$

The Sanctuary's average recreational value, measured in terms of CS per trip or tourist, has been calculated at INR 35,335.69 or USD 434 (based on an exchange rate of 1 USD = 81.41 INR as of December 2022). The issue of environmental deterioration can be addressed by accurately assessing and comprehending the economic value of natural resources. According to the data provided by tourists who visited the Sanctuary between 2013 and 2014, the estimated annual recreational value is INR 132 million, which is roughly USD 1.62m. The number of registered visits to the Sanctuary in the year 2013–2014 was 3,749. Table 5 and Figure 2 depict the yearly recreational value of the Sanctuary.

Table 5 presents the annual recreational value of the Sanctuary during a certain time frame indicating the tourist inflow over the years. This information is valuable for examining patterns, evaluating the effectiveness of conservation initiatives and making well-informed choices regarding the utilisation of natural resources in the region.

Table 5. Annual recreational value during 2011–2021

Year	Tourists in UP	Tourists in MP	Tourists in Rajasthan	Total tourists	Annual recreational value
2010–11	626	4,140	–	4,766	2,068,444
2011–12	750	1,938	–	2,688	1,166,592
2012–13	1,168	3,528	–	4,696	2,038,064
2013–14	1,069	2,680	–	3,749	1,627,066
2014–15	1,258	2,861	225	4,344	1,885,296
2015–16	1,421	2,640	236	4,297	1,864,898
2016–17	877	1,240	259	2,376	1,031,184
2017–18	1,490	1,191	242	2,923	1,268,582
2018–19	1,122	1,467	279	2,868	1,244,712
2019–20	1,803	1,035	96	2,934	1,273,356
2020–21	159	317	409	885	384,090

Source: Authors' own work
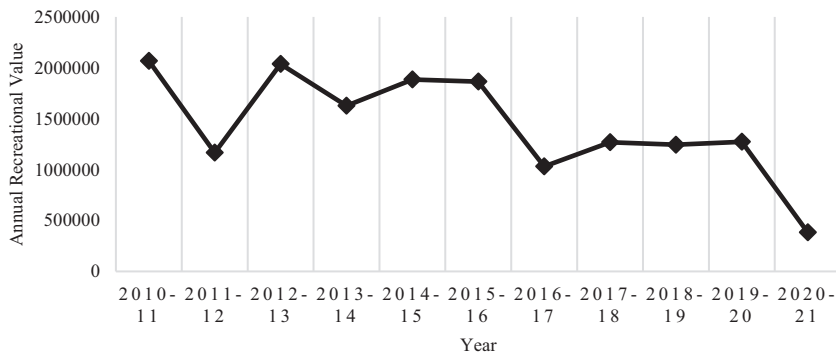
Source: Authors' own work

Figure 2. Annual recreational value over the years (2011–2021)

Figure 2 visually depicts this data, enhancing the clarity of trends and patterns. The Sanctuary, despite its abundant biodiversity, presence of endangered species and migrating birds, remains relatively unknown to many people. Despite the lower number of visitors, the Sanctuary is believed to possess significant recreational worth that has not yet been fully discovered by tourists.

6. Conclusion, policy implications, and future work

The results of our investigation illuminate the recreational worth of the National Chambal Sanctuary, revealing a wide array of activities that visitors engage in, such as birdwatching, wildlife observation, sailing and photography. By conducting surveys and interviews, we obtained valuable information on the preferences of visitors, with a significant number expressing a profound admiration for the Sanctuary's inherent beauty and diverse range of species. Ecotourism plays a crucial role in supporting conservation efforts in the Sanctuary because tourists participate in activities that actively encourage the preservation of habitats and the protection of species. Tourists gain a deeper comprehension of the significance of preserving delicate ecosystems and endangered species by fully engaging with the natural environment. Nevertheless, it is crucial to acknowledge that visitor preferences and local people's behaviour can also lead to unexpected outcomes, such as habitat disruption and displacement of wildlife. As mentioned previously, this study implemented the TCM for assessing the economic value of the National Chambal Sanctuary for the first time. Similar studies (Menendez-Carbo *et al.*, 2020; Kheyri *et al.*, 2020; Lamhamedi *et al.*, 2021; Alessandro *et al.*, 2023) applying the TCM for different parks and PAs sites justify the uses of TCM for economic valuation of park and forest. Additionally, the findings of this study are like the findings of Kheyri *et al.* (2020) that young age group and educated person tend to visit again and again with their friends and family while tourists from far locations are visiting the sanctuary rarely. The lack of advertisement and limited facilities are another reason that hinders the tourist inflow in sanctuary. The regression results show that the travel cost variable had the negative sign that indicated the high travel cost to visit the Sanctuary may lower the visit rate and vice versa, as mentioned by Lamhamedi *et al.* (2021).

The significance of recreational activities on conservation highlights the necessity for sustainable management strategies that achieve a harmonious equilibrium between recreation and conservation objectives. Ecotourism presents both benefits and challenges.

It provides a platform for increasing environmental consciousness and earning funds for conservation efforts. However, it also faces obstacles such as unlawful sand mining and a decrease in the number of tourists. The presence of these dangers poses a significant risk to the ecological stability of the Sanctuary and the continued existence of endangered species, thereby requiring immediate intervention from policymakers and stakeholders. By linking the results to the study's goals, the study emphasises the crucial importance of evaluating recreational value in guiding decision-making and policy development for Sanctuary management. Stakeholders can design specific plans to reduce threats and improve the long-term sustainability of the Sanctuary by comprehending the connection between recreational activities, conservation implications and sustainable management practices.

To summarise, the research highlights the significance of evaluating the recreational value while making educated decisions in Sanctuary management. The study acknowledges the issues posed by unsustainable practices, such as unlawful sand mining (a factor which may not be liked by tourists), while highlighting the substantial contribution of ecotourism to conservation efforts. To ensure the ecological integrity and long-term viability of the Sanctuary, it is crucial to adopt sustainable management practices following both bottom-up and top-down approaches that prioritise both recreation and conservation purposes.

This study has led us to propose targeted policy solutions to effectively tackle the issues confronting the National Chambal Sanctuary. These efforts encompass to have favourable entry fees and enhancing security to counteract illicit operations like sand extraction. Furthermore, the authors strongly promote the adoption of sustainable tourism practices that contribute to the conservation of natural habitats and the well-being of local populations. It is essential to include the evaluation of recreational value in decision-making and policy development to guarantee the Sanctuary's long-term viability. We advocate for the cooperation of government agencies, local communities and conservation organisations to successfully tackle these difficulties and advance the protection and sustainable development of the National Chambal Sanctuary. As mentioned by visitors, advertisement of Sanctuary at various platforms may attract more tourists in future. Young generation prefers adventurous and exploring new locations for their recreational purpose. This Sanctuary can have more facilities to attract young generation while catering scenic beauty for children and aged people.

Note

1. The Pseudo R^2 is generally low for models of qualitative dependent variable (Gujarati *et al.*, 2017).

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