




# An attempt to develop ecotourism in an unknown area: the case of Nehbandan County, South Khorasan Province, Iran

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## Abstract

This study is an attempt to develop ecotourism in Nehbandan County, in the South Khorasan Province, Iran, by representing unknown areas that have tourism potential. The most important obstacle in the development of tourism industry is the lack of strong marketing plans, tourism management, accommodations for overnight and long stays, and medical and health clinic in the desert. This is a qualitative, exploratory case study investigating the status of environmental, sociocultural, and economic impacts of ecotourism development on the native people's livelihood in Nehbandan County in Iran. The methodology is based on field observations, secondary data sources, and field survey. It is an interpretive approach that avoids numbers but focuses on issues linked to culture and nature. In the present study, the grounded theory was used to perform data analysis. Based on the findings, ecotourism has undoubtedly proven to be an effective environmental conservation tool in the study site and enables local people to increase their livelihood security through employment in activities relating to ecotourism and the development of rural livelihood.

**Keywords** Tourism management · Desert areas · Ecotourism development · Environmental conservation

## 1 Introduction

Ecotourism is merged with the principles of sustainability (MirarabRazi et al. 2020; Ramchurjee 2019; Sahani 2015) and is clarified as an environmentally accountable journey and visitation to fairly untouched natural zones. In this journey, the aim is to adore and acknowledge nature (plus any following cultural characteristics) that raises preservation (Jalani 2012; Shoo 2020), has minor visitor effects, and mends that ecotourism would present bigger multiplier profits in comparison to traditional tourism and thus, has a larger per unit addition to the economy (Ceballos-Lascurain 1996; Jalani 2012). Ecotourism

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has become a lot common during the last 10 years, regarding preservation and expansion. Most importantly, ecotourism is regarded as a chance for people living in tourism targets to achieve positive advantages from tourism expansion and the preservation of forests and guarded zones (Afenyo and Amuquandoh 2014; Burns 2005; Xu et al. 2017). Ecotourism has been explained as the fastest developing financial industry globally (Lu 2017; Fang 2020). It has been developed three times quicker than the common tourism industry and contributes to 6% of GDP worldwide and 11.4% of all costs (Fernando and Shariff 2013; Mowforth and Munt 2015). With the rapid development of ecotourism, the concept of ecotourism is also changing. At present, there is no uniform definition of the exact concept of ecotourism (Zhang and Zhang 2020). Ecotourism is seen as a sustainable mode of tourism that offers a solution to two major problems: poverty and loss of biodiversity (Brown et al. 1997; Cabral and Dhar 2020; Mowforth and Munt 2015). It has provided another prominent example of an activity that seeks to create a stream of revenues based on environmental services that can help fund the protection of those services. According to several organizations such as the International Ecotourism Society and universal union for the preservation of nature, ecotourism can be explained as an environmentally accountable journey to different zones in nature to cherish nature (and following cultural characteristics, both now and then) (Tietenberg and Lewis 2016). As planned to present profits to preservation and regional societies, ecotourism, viable tourism, and other types of nature tourism contribute to incomes and political backing, and it makes straight motivations to back wildlife, ecosystem, and landscapes (Fitzgerald and Stronza 2016). Sustainable tourism focuses on environmental issues relabeled from ecotourism (Mowforth and Munt 2015). The results obtained by ecotourism studies have an impact on natural ecosystems, but more importantly, these findings provide a way to promote conservation in ecologically fragile regions, benefit local community economies, and provide the public with an experience of nature-based education. Sustainable development is an important element of the development of ecotourism, which involves harvesting our natural resources without degrading or permanently damaging them (Mirsanjari 2012; Zhang and Zhang 2020). The research on ecotourism focuses on market segmentation, ecological impacts of wildlife viewing, and community-based ecotourism, but minimal attention has been paid to critical areas such as quality control, industry, external environments, or institutions, as well as the extension of ecotourism components and parameters. This imbalance, combined with the fragmentation and lack of literature integration, indicates that ecotourism is still in an adolescent state as a field of academic research (Weaver and Lawton 2007; Tietenberg and Lewis 2016).

Due to the above-mentioned explanations, South Khorasan with a large number of tourism appeals is like a precious stone in the desert (Ghorbani et al. 2015; Ghorbani et al. 2019a, b, c). The province has several ancient and natural locations such as Nehbandan County. The county is placed in a large plain next to the desert. Nehbandan has great potential to be considered as one of the important places in ecotourism market. Along with the increasing attention, the county can become one of the greatest ecotourism destinations in Iran (Eskandari Sani and Rezaei 2019; Maghsoudi et al. 2019). Despite all the attractions for different types of tourists, there is a low volume of tourism demand in this region. Unfortunately, this region has been kept deprived, isolated, and unknown so far. This has happened due to the absence of a strategic policy toward the tourism industry. Therefore, considering the high potential in this area, developing the tourism industry in this region in order to enhance its identity seems necessary. Despite the importance of the region due to its ecotourism potential, no effort has been made to present its current situation to the world. This study aimed to analyze the benefits of ecotourism development in Nehbandan County. This is a qualitative, exploratory case study investigating the status

of environmental, sociocultural, and economic impacts of ecotourism development on the native people's livelihood in Nehbandan County in Iran. The methodology is based on secondary data sources, field observations, and survey. The grounded theory (GT) was used to perform data analysis. As shown in Fig. 9, the main theme of the present study is to focus on the benefits of ecotourism based on the proposed framework. Furthermore, the study tried to understand how to introduce Nehbandan to more regional and global tourist industry. The dimensions of the framework used in the research can lead to the sustainable development of ecotourism in Nehbandan city. Given that many people in this region are dealing with economic problems and unemployment, the sustainable development of ecotourism is supposed to both preserve the environment and solve the economic problems of the natives. The results of this study showed that ecotourism is an effective tool for environmental conservation at the site of the study and allows local people to promote their livelihood security through employment in activities related to ecotourism and small business development. Accordingly, the objective of this research is to introduce ecotourism attractions and landscapes in Nehbandan to a larger community. In this way, the results of this study will help the planners and directors be aware of the vulnerable and young ecotourism business in the study area. The findings of this study will contribute to alleviating poverty in the study area by focusing on sustainable ecotourism development with socio-economic benefit to the people together with sustainable management of resources and conservation of natural resources. If adopted policies can be translated into practice, ecotourism in Nehbandan County is likely to improve the livelihood of the local community and utilization of local and national natural resources. This should further create people's awareness of nature conservation and sustainable use of resources. Therefore, the following principles could be considered for the study:

- *P1* The study area has a high potential for ecotourism development.
- *P2* Ecotourism improves the economic welfare of the local residents.
- *P3* Ecotourism creates positive sociocultural impacts for the local residents.
- *P4* Ecotourism creates positive environmental impacts for the local residents.

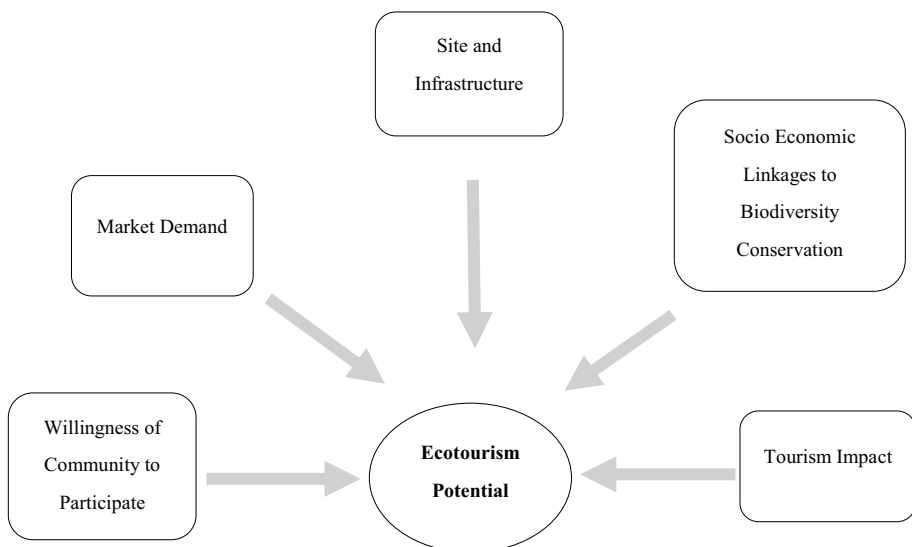
## 1.1 Literature review

The global expansion of tourism and ecotourism has brought economic growth (Cabral and Dhar 2020) and jobs in many related sectors (Eskandari Sani and Rezaei 2019; Mousazadeh et al. 2015; Shoo 2020). In addition, from construction to agriculture, and in many countries, strategies have been built to significantly enhance the number of visitors (domestic and foreign) (Mousazadeh et al. 2014; Mowforth and Munt 2015). In the present industrial world in Iran, where people are busy with stressful jobs, their need to relaxation and traveling to the natural environment has increased the attention to the phenomenon called 'Eco-tourism' (Aghajani 2014; Ebrahimi and Etemad 2019; Moosavi et al. 2013; Sayyed et al. 2013). Iran's true natural appeals have never been introduced properly to the world. The publicity is insufficient and even almost absent (Ebrahimi and Etemad 2019). Many forms of ecotourism fit the Iranian context and have the power to be directed according to viable expansion methods. A few studies in the past have been done on the expansion of ecotourism in Iran utilizing the strengths, weaknesses, opportunities, and threats (SWOT) technique (Aghajani 2014; Moosavi et al. 2013; Sayyed et al. 2013). Engar et al. (2014) applied the Norwegian travel industry scenario technique in 2025 and identified six drivers which are significant for the Norwegian tourism industry. This led to four scenarios that are

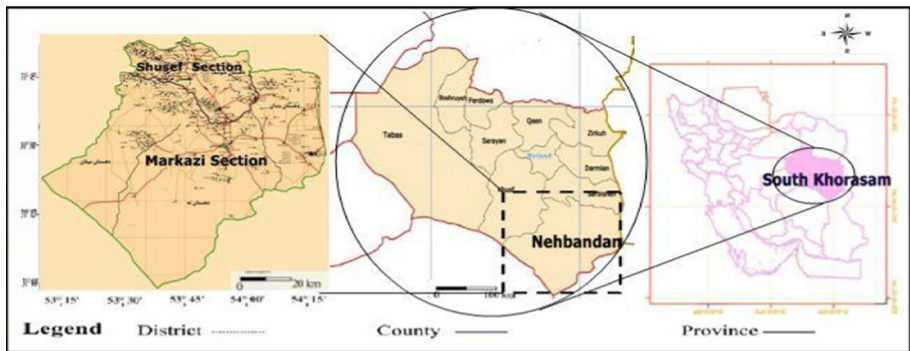
used to define implications and risks for various parts of the industry. Likewise, Samadzadeh et al. (2010) examined the promising ecotourism zones in Hastjin utilizing the SWOT technique. They came to the idea that the area has a great possibility for tourism expansion and with planning suitable schedules for tourism expansion of the zone, the zone would be safeguarded from dangers and would empower the area's economic state. Lanquar (2011) suggested four future scenarios in the Mediterranean up to 2030. In all cases, the arrivals of international and domestic tourists will increase. There are, however, three key factors that will greatly enhance the efficiency of the tourism sector. These factors include stability, competitiveness linked to the successful use of ICT, and climate change adjustment.

Based on the researches performed by Taghvaei et al. (2011) and Ebrahimzadeh and Agassizadeh (2009), utilizing geographical information system (GIS) and SWOT forms can aid us in mentioning a suitable technique for ESD. Moosavi et al. (2013) indicated that there is an extension for the betterment of the SWOT examination in determining more choices for crucial administration of viable ecotourism (Aryal and Maharjan 2018). The conceptual structure used to determine the potential for ecotourism is shown in Fig. 1. This figure shows that ecotourism potential is the function of market demand, the willingness of the community to participate in ecotourism activities, the socioeconomic links between tourism and the conservation of biodiversity, the capacity of the area to attract and host visitors, and the environmental impact of tourism activities (Aryal and Maharjan 2018) (Fig. 2).

There are different types of tourism in the tourism industry of any country, for which it is important to suit and adjust strategies to the nature of the destination. This industry has provided different policies and strategies for the development of any type of tourism in any country and sometimes the opposite (Asadi 2011; Camilleri 2018). Cultural tourism as the most essential form of tourism is no exception, and it will not be possible to prepare strategies for its development without taking account of its particular and remarkable environment (Asadi 2011; Fang 2020). Many eco destinations have been identified and consciously advertised in Iran, but the rate of poverty and unemployment is still on the



**Fig. 1** Conceptual framework for ecotourism potential. *Source* Aryal and Maharjan (2018)



**Fig. 2** The location of the study area (Nehbandan County)

increase even in communities that are host to these ecotourism sites (Asadi 2011; Ebrahimi and Etemad 2019). The reason for introducing ecotourism in protected areas is mainly to generate revenue to aid biodiversity conservation and pacify host communities of eco destinations through provision of basic amenities, but revenue can only be generated when tourists visit eco destinations. Tourism institutions in Iran regularly make many efforts to find new tourist attractions, but the particular challenges and level of development of many age-old ecotourism destinations are unknown, and many sites have either been ignored or destroyed (Ebrahimi and Etemad 2019). Iran has a broad cultural, natural, and historical resource base and a high potential to attract visitors of any kind. Iranian crafts play an important role in improving the economic, cultural, and social tourism infrastructure of Iran (creating opportunities for employment and attracting tourism, etc.). Iran's traditional arts include 300 different types such as pottery, carpet, jajim, kilim, glassware, ceramics, miniature, wooden works, engraving. (Asadi 2011). Iran has different weather conditions and exceptional biodiversity. However, restrictions like not having decisive arrangements, educational plans, and foundations have helped postpone the expansion of ecotourism in the country (Sayyed et al. 2013). South Khorasan is one of the three provinces that appeared after the division of Khorasan Province in 2004 (Ghorbani et al. 2015). Due to tension and insecurity in the Middle East, Iran's cultural tourism has been overshadowed by the presence of an unfavorable image of this country in global society. Iran's attractions are not only visited by domestic cultural tourists but also by tourists from other countries with cultural and historical links to Iran. Thus, we should not overlook the position of internal factors such as lack of government attention, strategic planning, accommodation, human resources, and innovation. In addition, cultural and communication barriers between communities and tourists, as well as the negative attitude of the authorities towards the cultural tourism industry, should not be ignored (Asadi 2011).

With attention to its geographical position, geological structure, climate condition, and geometric location, this province can provide sufficient means of subsistence to cover the living expenses. The province is located in the belt of the desert, with its dry climate with natural conditions, and as a result of the location, it has mainly a semi-desert climate. With attention to the climate of this region and the existing conditions of animals, plants, and wetlands, we could convert this region into one of the most attractive regions for tourism industry (Capabilities, Potentials, and Investment Opportunities of South Khorasan 2014).

## 2 Materials and methods

### 2.1 Study area

Nehbandan County is 41,102 km<sup>2</sup> wide and is located mostly in the southern part of South Khorasan which is equal to 27.3% of the total area of the South Khorasan province (Eskandari Sani and Rezaei 2019; Jafari et al. 2018; Hezarkhani and Ghannadpour 2019; Maghsoudi et al. 2019) (Fig. 1). The county, from the perspective of the natural situation, is located next to the desert of a big plain. To the north of this township, there are mountains, which are 2500 m high (Esmailpoor and Chehrizi 2014; Jafari et al. 2018; Hezarkhani and Ghannadpour 2019). Based on the public population and residence census in 2012, the population of the township was 57,258 people, the urban area population was around 19,776 individuals, and the village area population was 38,698 individuals (Esmailpoor and Chehrizi 2014).

South Khorasan Province, as one of the largest provinces in Iran, has a high potential for tourism development (Ghorbani et al. 2019a, b, c: 2). South Khorasan is one of the three provinces created in 2004 following the division of the province of Khorasan. While the newly created "South Khorasan" initially included only the county of Birjand and some new counties separated from that county (i.e., Nehbandan, Darmian and Sarbisheh), all northern and western cities and territories of old Quhistan (such as Qaen, Ferdows, and Tabas) were added to South Khorasan in subsequent years. South Khorasan is like a jewel in the desert, with a wide variety of tourist attractions (Ghorbani et al. 2015). Nehbandan County in this province has the potential to be the center of ecotourism in the east of the country by having a variety of natural attractions such as the world heritage of Lut desert, Kaji Namakzar wetland (KNW), and Martian mountains. However, the city is currently facing issues such as migration, drought, and poor tourism infrastructure. Through scientific development of sustainable ecotourism and proper marketing, many issues in the region are expected to be resolved, and sustainable ecotourism has good potential to solve the financial problems of local people (Eskandari Sani and Rezaei 2019; Maghsoudi et al. 2019).

### 2.2 Data collection and analysis

The aim of this study is to introduce and develop planned ecotourism in Nehbandan city of South Khorasan Province based on the development of a framework. In the first step, based on the framework (Fig. 9), open research questions were designed and an in-depth interview was conducted with the region's tourism experts. Then, field observations and literature review as secondary data sources were performed to obtain more accurate results. This is a qualitative and exploratory case study exploring the status of environmental, sociocultural, and economic impacts of ecotourism development in Nehbandan County in Iran. This method is an interpretive approach that avoids numbers but attaches importance to cultural and natural facts. In the final step, considering the specificity of the subject, the GT has been used to perform data analysis.

The current study is unique and timely as it contributes to filling the gap in the field of tourism in unknown areas by reviewing ecotourism potentials and the impact of ecotourism development in Nehbandan County considering economic, sociocultural, and environmental themes. In recent years, it has been observed that researchers in the field of tourism

have become more inclined to emphasize the high value and credibility of qualitative studies in tourism research (Truong et al. 2020; Molina-Azorín and Font 2016; Rittichainuwat and Rattanaphinanchai 2015). Given that the present study applied a qualitative research investigation, data were collected through 25 in-depth open interviews. It was also possible to correctly direct the interview process as well as interacting and exchanging ideas. For the interviews, the research statistics community was identified with key informant participants in the field of ecotourism industry and environmentalists from South Khorasan province, including Natural Heritage, Handicrafts, and Tourism Organization, Tourism researchers, Heads of the Department of Environment, General Directorate of Natural Resources and Watershed Management of the province, tourists, and tour leaders.

The collected data from the interviews were transcribed and the contents were analyzed multiple times. Eventually, with the presence of formal experts of tourism, the research themes were classified by the researchers. Yet, to enhance to quality of the research process, it is necessary to be clear about the role and interpretation of each particular code within the analysis methodology (Kuckartz and Rädiker 2019). This step is one of the most significant steps of GT, which needs the active cooperation of researchers. While applying the GT, categories and coding play a crucial role in data analysis (Kuckartz 2014). In this study, after transcribing the interviews using specified open coding, the data were classified into the stratum of relevant axial codes. Axial coding authorizes the refined sub-themes to be put together to identify themes and connections. Prior to the interviews, the questions and research objectives were explained to the respondents, hence, allowing them to provide detailed information on the research topic (Alipour and Arefipour 2020). The interviews need to be transcribed verbatim, reviewed for precision, and coded (Fuster-Ruiz de Apodaca et al. 2020). Therefore, the interviews were meticulously transcribed verbatim and then were sent to the interviewee for editing or approval (Quinn et al. 2020: 34; Lan 2020: 89). Then, open and axial coding of the interviews was done. Finally, the potentials of tourism and the effects of ecotourism in Nehbandan County were identified. As mentioned earlier, the findings of this study have been obtained through field observations and literature review as secondary data to achieve more accurate results.

### 3 Result

#### 3.1 Desirable backgrounds in the development of Nehbandan County's ecotourism industry

One of the most important aspects of ecotourism is the educational component which provides a chance to learn how to respect the natural environment and the local culture (Ehsani and Rastegar 2016). In the following section, we briefly mentioned ecotourism potentials in Nehbandan County.

##### 3.1.1 Kaji Namakzar wetland

KNW is a large salt marsh and because of its low altitude in comparison with other nearby areas, it has become a collecting center for the zone's drainage. Because of the reason that the salinity of the ground is noticeable, KNW has turned into a Salt Lake. In fall and winter, the water level rises and the area turns out to be a safe place for waterfowl migratory birds. Undeniably, it welcomes a lot of migratory birds yearly. Yearly,





**Fig. 3** Wildlife refuge of Kaji Namakzar

**Table 1** Flora and fauna variation in the study area.  
Source Akhiani and Deil (2012) and Golafshani (2014)

Flora/Fauna	Latin names of species
Birds	Golden eagle, Griffon vulture, Shikra, Little owl, Common quail, Pigeons and Doves, Pleske's ground jay, Red-billed Chough, Magpies, Eurasian tree, White wagtail, Crested lark, Greater short-toed lark, Swallow, Hoopoe, Roller, Black-bellied sandgrouse, Common ringed plover or ringed plover, etc. Reptiles: Echis, Spalerosophis d.schirazianus, Coluber karelini, Coluber rhodorhachis, Testudo graeca, Varanus griseus, etc.
Mammals	Wolf, Hyena, Fox, Porcupine, Rabbit, Hedgehog, etc.
Vegetation	Zygophyllum, Tamarix, Haloxylon, Atriplex, Salicornia, Phragmites australis, Artemisia sieberi, Alhagi, Ferula, Acanthophyllum squarrosum, Citrullus colocynth, Peganum harmala, etc.

more than 5000 migratory birds move to this place. KNW attracts a lot of tourists, and despite the continuing lack of water, this white salty lake continues to exist. The other important features are the exquisiteness of the site, a variety of the environments in a vast border, and the presence of significant natural zones in KNW district (Ghorbani et al. 2013). Nature tourism is the organized viewing of wildlife (Ahmad and Pandey 2016) (Fig. 3).

Because of having strong biodiversity, the wetland ecosystem gives animals, plants, and microorganisms a chance to live their lives (Li and Gao 2016). People are usually willing to spend more money on a place with a forest view or are willing to spend more time to do some fishing and bird watching leisure activities (Nasi et al. 2002). Bird and wildlife watching tours are not very old ecotourism activities in Iran, and now they have gained lots of followers. The large number of bird species residing in wildlife refuge of Kaji Namakzar has made it one of the most suitable destinations of Iran for birding and a highly crucial



known place for the migratory birds in the world (Makki et al. 2013). Flora and fauna are mentioned in Table 1.

### 3.1.2 Desert activities and playas

In the tourist imagination, the desert (Azar 2020) and paradise share similar qualities. They are both located away from the center and situated on the margin both geographically and in terms of time. Vast parts of Nehbandan County are covered with desert basins and surrounded by wonderful and unique landscapes. The western part of Nehbandan County consists mostly of deserts named Dehsalm and Heydar Abad Deserts. These desert areas consist of a greater variety of wildlife, animals, and plants (Hezarkhani and Ghannadpour 2019; Maghsoudi et al. 2019).

*Dehsalm* Dehsalm community is placed at 85 km's west of Nehbandan city on Nehbandan Shahdad Route. Lut Desert is amid the warmest locations worldwide. Therefore, the remains of animals never deteriorate. The strength of water evaporation does not let the animal remain decay by bacteria. This area is famous as a part of the Moon on Earth. Kalout (Yardang) is the essential feature of the Lut Desert located at 25 km's of Shahdad, and it will take not more than half an hour by car from the antithetic zone of Iran's icy mountain ranges. At the beginning of spring, these mountain ranges are full of snow—a fine summer place for nomads (Shirsalimian et al. 2017; Yarabbi et al. 2017).

Along the winter season, Shahdad is checked by many tourists, in a place that the icy climate of the Sirch town makes them be frozen to the bone. The legendary city of “Lalout”—an account of Kerman environment—placed at 130 km of Nehbandan is a marvelous zone close to Shahdad. It is not likely for any person to live in this legendary city; undeniably, continuing to live in this place is not imaginable. Yardang is a structure completed by several winds blowing on the soft ground of desert after many years. Rain on the dry plain of the desert makes the ground pile up around rocks and creates a lump similar to an adobe structure from an ancient evolution. Traveling to Yardang without a leader is risky since there is a probability of getting lost every now and then in a large city that is 110 km long and 50 km wide (Vidale et al. 2011).

The tallest sandy structures in the world, 40 quaternary volcanic funnels, large sand and gravel districts from light brown to black showing ‘gunpowder gorge’ wavy and sandy areas, ridges enclosed with plants, Camel Toe Desert (after torrential rain it seems that camels have trodden on it), Hammada (heats of gravel), and rivers full of salt are among scarce miracles of the Lut Desert. Sand skiing is promising for spending money on it for tourist appeals, but not started in Iran yet. The Heydar Abad playa is located in the Southwest, which is considered to be one of the driest places on Earth. According to NASA studies, “Hyderabad” since 2005 has been recorded as the hottest spot on Earth. This desert still enjoys a great variety of wildlife, animals, and plants (Tarawneh et al. 2013).

*Heydar Abad Desert* The sandy Yalan is close to Heydar Abad in Nehbandan. It is clear from NASA satellite detectors during many succeeding years that this place is the warmest place worldwide and the highest sandy mountain ranges are located here. The Wikipedia Travel News, which is among the most trustworthy tourism sources on the net in the world, has declared this scarce desert as one of the twelve most amazing adventure tourism zones worldwide, and it is believed that a journey to this place is similar to moving into space (Shahamat et al. 2019) (Fig. 4).

Tourists enjoy different day and night activities in the desert. Camel-riding, trekking, and sky exploring at night are among the most famous ones (Sallam et al. 2020). In some



**Fig. 4** Heydar Abad Desert in Nehbandan

parts of Nehbandan deserts, especially Dehsalm and Heydarabad deserts, tourists may be accommodated in well-equipped local homes, inns, eco-camps, or even some historical caravansaries in the heart of the desert. Camping, photography tours, and conducting research or training projects about the desert's natural and cultural heritages are other common activities in Nebandand deserts (Maghsoudi et al. 2019; Shahamat et al. 2019).

*Paragliding* In the adventure tourism industry, paragliding has become one of the most popular extreme sports. Paragliding is defined as a sport using a single seater, non-motorized, flexible aircraft which is steered aero-dynamically. It can also be started from ground level without requiring a free-fall phase. Paragliders are easily transportable low-cost aircraft which are becoming increasingly popular. Tourists can glide over nearly most parts of Nehbandan. Flying over the Heydar Abad desert, Dehsalm, and the yellow lands of Nehbandan deserts is a very specific experience for those who like this sport. In Heydar Abad, some sites are prepared with gliding training classes, and professional contest tours are also available (Maghsoudi et al. 2019).

*Sandboarding and sand sledding* In tourism, a growing craze is sandboarding (Firestone and Karlin 2010). Riding on a pair of sand skis and skiing down steep sandy slopes at enormous speed is just incredible. A great way to enjoy sand skiing in Nehbandan is to take a day trip. A popular option is to combine sand skiing with a camel ride, combining the best two great desert sports. Skiing on Nehbandan's desert dunes takes a totally new meaning (Yazdi et al. 2014). The best sand dune for sandboarding and sand sledding in Nehbandan County includes Heydarabad and Dehsalm's sand dunes. Both regions boast the world's largest dunes that tower hundreds of meters above the surrounding plains. Sand dunes in Heydar Abad are the sand skiers' paradise. As mentioned above, the highest dune is approximately 520 meters above sea level, which is also called Sandy Everest in this region and is a favorable location for sandboarding and sand sledding (Shahamat et al. 2019; Yazdi et al. 2014).

### 3.1.3 Nehbandan-Shahdad road (1 of the 7 hottest road trips in the world)

Many ways exist to estimate the heat which is one of the difficulties to compare heat temperatures. Most of the warmest places are very far to reach and no weather sites are available. NASA utilized one satellite to estimate outward heat records in the world from 2003 to 2009 for 7 years. The Lut Desert was the warmest zone worldwide in the first 5 years (in the other 2 years, Turpan, China, and the state of Queensland, Australia, where Birds Ville is situated, were the warmest places) (Maghsoudi et al. 2019; Yarabbi et al. 2017). The Lut Desert hits 159° Fahrenheit, the warmest outward heat record ever documented. The satellite was not capable of estimating the outward heat record, but everyone is likely to be certain that it is extremely warm; even bacteria are not able to live in this extreme heat and unrefrigerated milk does not decay in this place since it reaches the boiling temperature. One route goes from one side of the desert to the other, from Shahdad to Nehbandan. However, there is not a lot to see on this 180-mile journey; the word “Lut” signifies the word “emptiness” (Maghsoudi et al. 2019; Shahamat et al. 2019).

### 3.1.4 Rural tourism

Pastoral tourism is a shape of tourism which has gained further consideration in the current years. Spending money on pastoral tourism is likely to be beneficial for the betterment of the lives of regional people (Kheiri et al. 2016). Rural tourism is a complex multi-faceted activity. Nature tourism will contribute to rural development. The world's oldest rural locations that have been explored are in the East of Iran. Now there are several villages in all geographical parts of Nehbandan County and each one has its special cultural and natural attractions. The local people's disposition is very kind and hospitable and tourists can stay in well-equipped rural homes and enjoy the unique experiences of living among locals. Handicrafts, fruits, and dairies are the most common souvenirs of Nehbandan's villages. The village of Dehsalm is the most important tourist destination in South Khorasan Province. The village of Dehsalam is located in the city of Nehbandan and is located 85 km's southwest of the township situated at 85 m's above the sea level and covers an area of approximately 2000 hectares (Shahamat et al. 2019; Yazdi et al. 2014).

Dehsalam pastoral town is a green desert and is famous for its massive palm trees. The Dehsalam communities are friendly and forbearing under the strong heat of the desert. Usual mat knitting is a seasonal handicraft of this town (Shirsalimian et al. 2017; Yarabbi et al. 2017).

### 3.1.5 Mountain attractions

Zones with mountain ranges are the second common areas for tourism which come after coastal ecosystems (Holden 2016). Around 10 km far from the town of Nehbandan to Shahdad on both sides, the mountain ranges can be obviously observed, which are recognized as the Miniature or Mars Mounts. These scenic mountain ranges are naturally made with solid residue and because of quick deformation by the wind and rain, their figures have been made with many edges and bumps. The local mountains of this district are named “Mars” (Merrikhi), as a result of their abnormal figures. Nearly all the mountain ranges are in white, in-between gray and white, with many debris at the bottom of them, and regardless of the heat, they make dramatic pictures that excite the observer's mind and

make this route one of the most scenic places in Iran. In one place, there is the Mars Conical Mountain with terrific gray paint and in the other place, there is the sandy gravel route, the Lut Desert of Nehbandan's locality which shows a scenic natural lure. Previously, this mountain was hidden under a lot of dust, but now, it can be clearly seen. With the influence of weather changes and monsoon showers, the ground has been gradually swept away from the hillside and the surface of the mountain is clear now (Maghsoudi et al. 2019; Shahamat et al. 2019; Yarabbi et al. 2017) (Fig. 5).

### 3.1.6 Gandeh Kav waterfall

The waterfall has long been appealing for the tourists, and a few of the travelers have been writers and artists who have given us a cultural heritage of their notes and opinions (Hudson 2016). One of the most beautiful seasonal waterfalls in the East of Iran is located



**Fig. 5** Miniature or Mars Mounts

75 km's north of Nehbandan County in Chah Deraz. Chah Deraz is a village in Shusef Rural District. There are different springs in the area which are then funneled into downstream springs. This waterfall is the main attraction of Nehbandan County (Kees et al. 2007). See Fig. 6.

### 3.1.7 Cultural and heritage attraction

Regular and cultural landscape appeals are the foundation for ecotourism's significance, together with regional nutrients, farming systems, regional handiworks, local clothing, old happenings and communities, traditional attractions, structural diversity, local music and dance, imaginative performances, etc. (Archer et al. 2020; Kiper 2013).

*Petroglyphs, ancient rock art* Petroglyphs are an example of universal rock arts and the oldest historical traces left behind from the ancient men. They refer to any images on rock surfaces created by incising, picking, carving, or abrading them, as a form of rock art. These arts reached a peak after the discovery of metals and were converted from simple cup marks to petroglyphs with strong artistic techniques and abstraction approaches (Naseri Fard 2010). These ancient rock arts in the Nehbandan region are seen in petroglyphs of "Hijesto Valley" near Heydar Abad Village, "doho" between the villages of Chagdashi, Dehsalm, and Ramingan. Petroglyph stencils include antelope, man, sun, tree, horse, and script. The oldest petroglyph dates back to the second millennium BC (Shabani and Nehbandan 2007).

*The Asbad (Windmill) of Nehbandan* Challenging natural places in the deserts in Iran have made communities utilize their inspiration and revolution to benefit from normal factors and circumstances to manage them. Being extended all along the south of Khorasan Province, particularly in small towns of Nehbandan, asbads of Nehbandan are examples of these inspirations. Nehbandan is a significant zone because Sistan's 120-day winds are extended all along the region. Most asbads are fixed in Nehbandan. Char-Farsakh,



**Fig. 6** Gandeh Kav waterfall



Gavand, Khansharaf, Mighan, etc. are other small towns where several asbads are fixed. The Nehbandan windmills rotate utilizing the wind power. With regard to their structures, origin, and appearance, Nehbandan windmills belong to the Qajar dynasty (Saeidian et al. 2012) (Fig. 7).

*Nehbandan Castle* Based on architecture programs and clay relics, the traditional foundation of the castle goes back to a time before Islam such as Ashkanis and Sasanis. The castle was active until the time of the Safavi dynasty during the Islamic era. However, it was entirely deserted at the time when the Safavi was in power. The appearance of this castle supports those traditional resources demanding that Nehbandan had been created before the Islamic period (Dana et al. 2016). See Fig. 8.

*Local music and dance* Local music in the south of Khorasan and Nehbandan County has an extended history that is rhythmic and dramatic with its movements which turns it into something particular and the dancer hits hand-made wooden instruments in harmony with music. The most memorable and striking songs and heroic dances plus writing poems are available in South Khorasan. Some musical instruments are timpani, reed, hornpipe, and circle which are mostly made by music makers, but these are not all. Some pieces of music in this district are Asil, Narenare, Right and Left, Shirjeah, Ahval, and Sezarb (Saneinia et al. 2020).

### 3.2 The impact of ecotourism development on Nehbandan County

Nowadays, the impact of ecotourism on wildlife and indigenous people has become a controversial issue (Ahmad and Pandey 2016). The impact itself can be ecological, social, and economic (Fauaia 2016). Ecotourism tends to develop the positive effects by a particular concentration on preservation, advantages for host crowds, and the training of visitors (Bien 2007). Therefore, this section is going to discuss the most important impact of ecotourism development in Nehbandan County. The imagined structure that appeared in

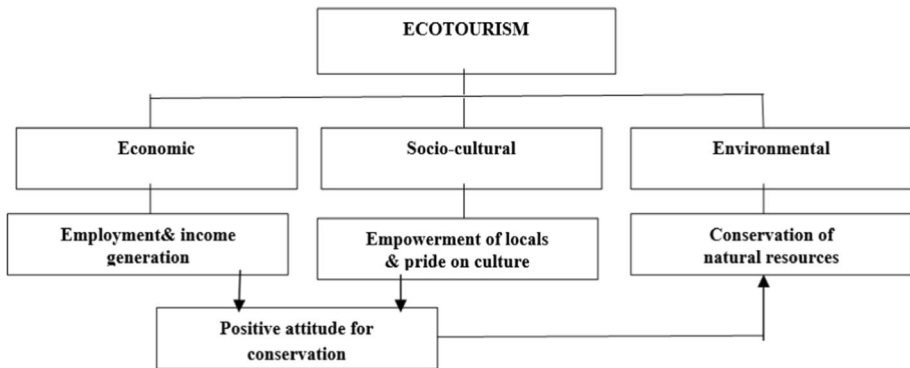


**Fig. 7** The Asbadd windmill of Nehbandan





**Fig. 8** Nehbandan Castle



**Fig. 9** A framework for analyzing ecotourism impacts (Das and Chatterjee 2015)

this part is expanded regarding the aims of ecotourism. Ecotourism heads for the preservation of nature by palpable betterment in the regional economy and stronger admiration for regional culture and customs (Fig. 9).

### 3.2.1 Economic impact

Ecotourism is a market-based preservation technique that empowers economies and advances the behavior of people's outlook regarding preservation labors. Ecotourism leads to economic well-being by influencing numerous parts of spending in the financial plan of every family in a positive and important way. It does so through strengthen their monetary

return from ecotourism (Fang 2020; Lu 2017). Ecotourism was expanded as a technique to preserve biodiversity by giving monetary advantages to the regional communities all around the supported zones. Ecotourism is being mentioned as a financial power saver by several local people who are encouraged by the availability of job opportunities, modern business chances, and modern skills expansion (Das and Chatterjee 2015). As a result, Nehbandan has tremendous potential for ecotourism. However, youth unemployment has remained stubbornly high despite rapid economic growth in recent years (Chigunta 2016). The expansion of ecotourism in Nehbandan will make professions in tourism services like home-stay housing; restaurants; souvenir shops; and food, transport, and helpful services that will provide regional communities with straight financial advantages. The development of ecotourism attracts foreign investors to start projects such as eco-lodges, hotels, and restaurants in local communities. These investment opportunities create opportunities for local people to be employed. The impact of the development of ecotourism on other parts of the economy and, more generally, on local and regional development is generally crucial based on the results. In addition, an increase in the number of tourists staying overnight in hotels would directly boost the hotel sector's sales. The direct effects of tourist spending are the additional sales of hotels and associated changes in hotel payments for wages and salaries, taxes, supplies, and services. Another round of indirect effects are enterprises supplying products and services to the food supply industry, eventually linking hotels to many other economic sectors in the region to varying degrees. Overall, ecotourism has definitely come as an economic rescuer for many people with various job opportunities for the villagers, who do not have a wide avenue of earning due to lack of infrastructure, education, training, resources, etc. In unknown areas, due to the existence of natural and untouched attractions, tourism activities help in achieving sustainable local economic development as well as communities' empowerment. Furthermore, results in the economic section highlighted that ecotourism development in Nehbandan County can make many cases for entrepreneurship and self-employment tourism business for local people. Accordingly, the development of ecotourism in the region can strengthen other branches of tourism as well, which in turn, can have positive and direct economic effects on the region. The rural people of Nehbandan produce special and organic agricultural products and have their own local clothes. On the one hand, with the development of ecotourism in this region, the rural tourism economy can be strengthened, and on the other hand, local festivals and markets can be set by economic goals.

### 3.2.2 Sociocultural impact

By increasing the living standards of the regional communities, ecotourism strengthens them in a social and political way and brings about respect for many cultures and for human rights. Not direct motivations such as better foundations, health equipment, knowledge, and training from tourism expansion expand promising outlooks toward preservation (Nyuapane and Poudel 2011). Another important impact in this section is ecotourism and community participation (Das and Chatterjee 2015). The developing countries are especially interested in diversifying their tourism aids by group attendance to draw the attention of more tourists and give advantages to country zones. This factor is absolutely central to the advocacy of ecotourism (Ballantyne and Packer 2013). Nehbandan's Local Community involvement in ecotourism efforts provides benefits for the communities, in particular through their direct jobs, and raises awareness of conservation activities that protect forests and wildlife. Finally, as a result, Nehbandan, which is located at the southern point of

South Khorasan Province today, is faced with many challenges such as incessant drought and desertification, emigration, etc. Ecotourism can help in strengthening regional people by giving monetary, community, political, and psychological advantages. Steady monetary earnings from official and unofficial parts in employment and business chances strengthen people's financial condition. On the other side, the increase in the number of tourists in ecotourism areas causes sociocultural improvement, but if tourist activities lead to over-population, misconduct, begging, moving from local lands, or adultery, then they will also cause losing power in the society (Das and Chatterjee 2015). Finally, the most important aspect of sociocultural impacts for unknown areas such as Nehbandan includes empowerment of locals and increased pride in their own culture. The tourism industry transforms friends, families, and neighbors' social relationships into financial relationships. It can also separate communities from their local traditions and can create a sense of local cultural products being commercialized. One of the commercial practices may become the initially welcoming attitude towards tourists. If the number of tourists in the region rises rapidly, a degree of hostility may result in a reduction in traditional hospitality, including the feeling of unwelcoming caused by the constant presence of outsiders.

Ecotourism's numerous positive sociocultural impacts outweigh the adverse ones. In addition, it also enables villagers to work from home, providing them with general social and psychological well-being. Some of the sociocultural impacts include the development of infrastructure, tarred roads, lodges and camps, and social services improvements. Raising understanding and respect for local culture is largely related to the adherence in most protected areas to the principles of ecotourism. It is necessary that ecotourism be sensitive to local cultural norms. In addition, sensitive beliefs that local people should accept and promote and sustainable development should be respected. This is feasible if all stakeholders (government agents and local people) work together to formulate, implement, and monitor policies that can promote positive cultural effects. The main sociocultural features of Nehbandan County are diverse. For example, in terms of religion, clothing, language, and even customs, most of the inhabitants of the province are different. The results showed that most of the areas that have faced a decline in population, migration, and low levels of social stability are mostly located in the desert and border regions. Identifying social capacities and using them can be directly effective in solving such social problems of unknown areas and provide the possibilities for growth and improvement of living conditions and sustainable settlement of the population and prevent the emergence of important migration challenges.

### 3.2.3 Environmental impact

The environmental influences of a few adventure deeds might be harsher than those from trekking and rambling due to the continuous and hefty utilization of facilities on the landscape (The Case for Responsible Travel 2016). In other aspects relating to the environmental impacts, one of the important goals of ecotourism is to lessen the undesirable environmental effects and improve environmental knowledge plus cultural knowledge and admiration (Ballantyne and Packer 2013; Das and Chatterjee 2015). For unknown areas such as Nehbandan, the most important environmental impact of ecotourism includes providing direct financial benefits for conservation, unknown natural attractions, and building environmental awareness (Ghorbani et al. 2015; Ghorbani et al. 2019a, b, c). Ecotourism, however, can also have numerous adverse effects on natural resources, ecology, and local environments. The environmental impact of ecotourism in the study area is based on the

results of various activities, including development, unregulated recreation, pollution, disturbance of wildlife, and vehicle use. For ecotourism, these effects are more severe than for general tourism, as the former depends more on a relatively beautiful natural environment than the latter, particularly in terms of attracting new travelers. Nevertheless, the desire to maintain only the biodiversity and ecosystem or to improve the environmental governance of ecotourism sites without taking care of the basic livelihoods of people or the dispersion of ecotourism benefits would lead to an endless failure of the district's ecotourism initiative. Therefore, increasing environmental tax and efforts like adding to budget and using more advanced technology cannot be the main key strategies to success. Overall, populated tourist areas can have negative environmental impacts, such as reductions in flora and fauna abundance and diversity, decreases in area aesthetics, and decreases in water and air quality. Additionally, the destruction of natural habitats, noise pollution, soil erosion and landslide, loss of nutrient quantity and quality, loss of ecosystem services, and deterioration of archeological sites, cultural monuments, and heritages could be the results of traditional (classic) ecotourism development.

Postmodern ecotourists are more sensitive to nature conservation. Due to developing ecotourism in Nehbandan, this region can be the tourist destination in Iran and even the destination and host of many international tourists. By developing ecotourism in Nehbandan, postmodern ecotourism can help maintain and build environmentally friendly strategies in tourism development in this region. In addition, the possible adverse effects of ecotourism on the local community can also take a toll on wildlife. It is ironic that despite the classical ecotourism aims to train tourists and increase the conservation of natural heritage, the presence of ecotourists may negatively affect their environmental behaviors. Increased tourists' footprint traffic can also affect soil and plant quality and damage the ecosystem.

## 4 Discussion and conclusion

The goal of this study was to develop ecotourism in an unknown area. To achieve the goal, this study has developed a framework (Fig. 9) and has considered four principles. Therefore, in this section, the main findings of the article are discussed based on the principles and dimensions of the proposed framework. Nehbandan County as an unknown area has a high potential for future ecotourism development. Similarly, unidentified lands are able to be regarded as a fresh endpoint for ecotourism. Therefore, directors and officials are required to focus on the roads' expansion so that visitors can have access to the area in an easy way. The results acknowledge that other researches came to similar results (Moosavi et al. 2013, Sayyed et al. 2013). In terms of cultural values, this region has different attractions such as ancient inscriptions and petroglyphs, windmills, local handicrafts, local foods. The most popular tourist village destinations are Dehsalm, Heydar Abad, Kaji Ollia, Sofla, and Khansharaf. In terms of natural values, Nehbandan region has different attractions such as Kaji Namakzar wetland, Gandeh Kav waterfall, Heydarabad and Dehsalm deserts, and mars or Miniature Mountain. The most important ecotourism attractions in Nehbandan are concentrated in the western part of Nehbandan-Shahdad's tourist road, connecting them to Nehbandan city and the province's capital city. Despite the diversity of ecotourism attractions in Nehbandan, there are some major obstacles to ecotourism development. The most important obstacle in the development of this industry is the lack of strong marketing plans, lack of tourism management, lack of adequate accommodation for overnight and extended stays, lack of medical facilities and health clinics in the desert, and lack of Desert

Eco-Cap within the desert area for tourists. Unfortunately, the existence of unsustainable activities such as burning bushes, mass tourism, illegal hunting, suspicious or unauthorized activities utilizing water wells, and unauthorized misuse of water wells can easily damage and destroy such a fragile ecosystem and lead to the drying out of springs. Improper desert and ecotourism activities have led to different problems such as environmental pollution, vegetation destruction, the destruction of natural landscape, and finally, migration of wildlife populations. This finding is confirmed by Ghorbani et al. (2013). Ebrahimzadeh and Agassizadeh (2009) mentioned that tourism activities in Iran's natural lands, like wetlands and local parks, did not provide viability needs due to the difficulty of viable ecotourism expansion in these zones.

In tourism management dynamics and with the entry of postmodernism in tourism, destination organizations need to change their view about ecotourism management in order to take advantage of tourism revenues and accelerate the development process (Ghorbani et al. 2019a, b, c: 68). The proposed framework (Fig. 9) in this research can be the basis for changing the ecotourism management of Nehbandan County. The framework shows that ecotourism should be developed in a way that protects the environment instead of destroying it. The framework emphasizes that the development of ecotourism in Nehbandan County can have two types of direct and indirect positive impacts on the region, which can eventually lead to the conservation of natural resources (Dhakal 2020). Similar studies suggest that ecotourism can help protect natural resources by improving community awareness and changing their behavior (Prihanta et al. 2020: 1). This aspect of ecotourism development is precisely the ultimate goal of this research. On the basis of the framework, the economic, sociocultural, and environmental impact of sustainable ecotourism on the native people's livelihood is directly positive. One of the researchers in this article, as the tour leader, has taken different groups of tourists to Nehbandan County. In the presence of ecotourists, natives sell their organic products and handicrafts to them and use their houses in the villages to accommodate tourists, and in this way, both ecotourists and natives are happy. Ecotourists also rent natives' camels to travel to the desert and buy their local clothes. This shows the secondary economic effects of the Nehbandan County ecotourism on employment and income. In unfamiliar environments, due to the existence of natural and untouched rural attractions, community empowerment and sustainable local economic development are needed (Wijijayanti et al. 2020). Empowerment of the local area can have a significant impact on changing the attitudes of natives. Based on the proposed framework, indigenous people are now aware that the natural environment is an important factor in their well-being, so they have to take care of it. Several studies have similarly focused on educating local communities in terms of the role of ecotourism (Stone and Nyaupane 2020: 1426). Considering high ecotourism potentials in Nehbandan County, it is necessary to introduce a new approach for sustainable tourism development. The new approach should consider environmental, social, and economic dimensions of sustainable development. Implementation of such sustainable programs involving all stockholders will maximize the benefits of future development programs while minimizing the negative impacts. This is an exploratory case study exploring the status of environmental, sociocultural, and economic impacts of ecotourism development in Nehbandan County in Iran.

Considering high ecotourism potentials in Nehbandan County, it is necessary to introduce a new approach for sustainable tourism development. The new approach should consider environmental, social, and economic dimensions of sustainable development. Implementation of such sustainable programs involving all stockholders will maximize the benefits of future development programs while minimizing the negative impacts. Considering the result of this research, without a doubt, ecotourism has been recognized to be

an influential environmental preservation instrument in Nehbandan County. Ecotourism allows regional people in Nehbandan County to start their occupation by employing ecotourism linked activities and minor enterprise expansion. Steady economic achievements by official and unofficial employment part by ecotourism strengthen the society financially. Ghorbani et al. (2015) reported that South Khorasan is one of three provinces formed in 2004 after the division of the province of Khorasan. Despite this region's importance in terms of its potential for ecotourism, no effort has been made to present its current situation to the world.

This discovery is suggested by Das and Hussain (2015) who claimed that ecotourism provides economic well-being by influencing numerous parts of spending in the financial plan of every family in a positive and important way. This economic betterment leads to better foundations, health equipment, knowledge, and training of the regional communities that in turn authorize them socially. In his report, Asadi (2011) suggests that improving infrastructure, offering high-quality cultural goods, attracting potential visitors, and concentrating on countries that rivals were unable to reach, are other strategies for expanding this market. Cultural regions are of vital importance to this industry for sustainability and balanced growth. Cultural tourism targets can be achieved through the renovation and creation of cultural tourism regions and cultural corridors, cultural product diversification, the provision of unique and distinguished cultural products to cultural tourists, and the holding of festivals and artistic and cultural ceremonies throughout the world. Strengthening local communities can also be effective in this regard by teaching concepts of cultural attractions management, good contact with cultural visitors, and reorganization, restoration, protection, enhancement, creation, and exploitation of cultural attractions. Masud et al.'s (2017) main findings indicate that environmental awareness of sustainable growth, inspiration, economic effect, social impact, and cultural impact of community-based ecotourism contributes to positive intention in managing community-based ecotourism and promoting community participation. The findings of the study conducted by Tseng et al. (2019) show that group engagement and events contribute to the potential for ecotourism. Public engagement is the causal factor of the growth of ecotourism and enhances the ecotourism capacity by affecting ecotourism practices, the valuation of attractions, and the management of facilities. In practice, the highest causal criteria have the greatest impact on the capacity of ecotourism. These criteria are tools to help boost the ecotourism potential and the level of its performance. The findings of the study by Amalu et al. (2018) revealed that the ecotourism industry has attracted benefits such as job creation, career opportunities, enhanced family income, local product patronage, and improved transport system. Regardless of these benefits, the current study also revealed increasing challenges such as lack of skilled labor force, lack of government involvement, lack of participation by the private sector, poor management of ecotourism sites, insufficient security, lack of standard supermarkets, and poor accommodation facilities.

Moreover, the proof proposes that ecotourism would give bigger multiplier standards in comparison with mass tourism and thus provides a superior per unit help to the financial condition. Regarding sociocultural effects, ecotourism supports encouraging results by authorizing regional communities to be owners and stakeholders in ecotourism programs. It also authorizes regional occupants to utilize administration methods that are dependable on regional standards. The results acknowledge that other researches came to similar results too (Das and Chatterjee 2015; Nyuapane and Poudel 2011). Tourism is at the forefront of many economies but comes with negative externalities contributing to reduced efficiency of the environment. Instead of these mass tourism activities, various alternative types of tourism are practiced with the goal of improving positive externalities while retaining control and balance



against negative externalities (Aryal and Maharjan 2018; Wondirad et al. 2020). Though previous researches regarding the actual environmental impacts of ecotourism have yielded both positive and negative results, the potential for ecotourism to positively impact our natural environment is undoubted. One way to positively impact the natural world through ecotourism is to use education to promote pro-environmental learning outcomes in participants. Because visitors' learning is an essential element in ecotourism, education has been researched extensively within ecotourism contexts. However, specific instructional strategies that can facilitate pro-environmental learning outcomes during ecotourism experiences have not yet been analyzed. Academics and practitioners have generally advocated ecotourism as a possible contributor to conservation and development. Others have, however, questioned whether this type of tourism would attain sustainability objectives. The lack of effective cooperation between stakeholders is the characteristic of numerous factors described in the literature as impeding the progress of ecotourism. The researchers followed an exploratory study approach and conducted in-depth interviews with stakeholders, between 2016 and 2018, and focus group discussions. The findings revealed poor communications among ecotourism stakeholders and collaborations. Consequently, failure to mobilize and engage in communities in poorly resourced and remote destinations threatens ecotourism and endangers the long-term sustainability of habitats. In this paper, we explored the historical evolution of the ecotourism policy in Nehbandan County. Then, using empirical research from secondary sources on ecotourism, the economic, social, educational, and environmental benefits of community-based ecotourism were explored in the study area. It was concluded that the focus of ecotourism for development would change to locally regulated and participatory forms of community-based ecotourism in order to achieve sustainable development targets in Nehbandan County and other similar areas. The limitation of this study was the complete reliance on previously published research and the availability of these studies as well as their suggested methods and approaches. The results of this research can contribute to moving to mass and sustainable tourism and ecotourism. Certainly, the future of ecotourism and sustainable tourism lies in the synergy between the various forms of tourism. In this development, mass tourism has its place and it would be naive to think that without mass tourism, ever-growing tourism on this planet could continue. Therefore, planners and managers are challenged to make a difference. The study of ecotourism development would greatly benefit from further research as a major contributor to conservation and sustainable development in the study area.

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## Compliance with ethical standards

**Conflicts of interest** The authors declare no conflict of interest.

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