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**ORIGINAL ARTICLE****Contribution of Geomorphological Assessment for Sustainable Geotourism: A Case of Iran's Desert****Mahdi Eshraghi, Habibah Ahmad, Mohd Ekhwan Toriman**

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Mahdi Eshraghi, Habibah Ahmad, Mohd Ekhwan Toriman; Contribution of Geomorphological Assessment for Sustainable Geotourism: A Case of Iran's Desert

**ABSTRACT**

Deserts have enormous unique natural and human attractions, although there are many superficial roughnesses. Generally, when managed and operated properly, desert attractions provide ample benefits including a highly profitable industry of tourism. The prosperity of Geotourism in desert areas also helps to broaden the economic spectrum of the country which is normally unproductive agricultural and industrial activities, but also revives to improvement quality of life of local communities. This article focuses on geomorphological characteristics of desert areas of Kavirs which cover about 25 percent of Iran's area. These regions have a collection of all the geomorphological phenomena related to deserts. Here, geological relics have been found including landforms, water landscapes, paleontological remains and rock formation. Iran's two great deserts, Lut Kavir and Great Kavir, are vast and, relatively unexplored regions in the eastern part of central Iran. The deserts include three of the world's phenomena. First, Ghourd: the world's highest sand pyramids which are huge sand dunes 2000m long and 500m high. Second, Yardang or Kalut: an area of 150 km long, 70 km wide and 80m high, which comprises long deep moats (ditches) created by storms and floods. Third, being the hottest point in the world as recorded by the satellite images. Iran deserts also contain a variety of sand deposits such as seif, barkhan, yardang, sand pyramids (Ghourd), sand channels and nebka. Vast clay and saline lands as well as salt polygons are other ubiquitous features of its deserts. This article also identifies the geomorphological features that lead to Geotourism development and demand for Iran's unique desert tourism.

**Key words:** Geotourism, Geomorphology, Sustainability, Desert, Iran**Introduction**

As one of the different types of tourism Geotourism is a new industry in some countries which can develop Geotourism potentially. Geotourism is a kind of cultural-environmental tourism with specific geology and its attractions, creating a dynamic relationship between the nature and the culture of a region and tourists. Also sustainable Geotourism is a form of planning for tourism that attracts tourists, using Geology, Geomorphology and environmental-cultural resources, in to order respond to the needs of economic, social, cultural and legal regulations and community expectations can be unity and integrity of tourists and cultural identity, environmental health, balance economic, welfare of people and their guests in a balanced and continuous supply optimization. In fact in Geotourism the effort involved the environment is not done by humans, but inevitably, if something took these actions should lead to the perfection in nature. Also improving the quality of life of local people is the main aim of Geotourism.

Local communities benefit from tourism and mutually attempt to protect tourism resources and responsibility. So one of the most important achievements Geotourism is promoting, which was defined as sustainable tourism [10]. In other words Geotourism is an environmental – cultural responsibility for protecting is biodiversity and local heritage. Considering the importance of sustainable development Geotourism, research and development programs based on the Geotourism has some aims including:

- [1] Protection of natural resources and cultural tourism;
- [2] improving the quality of tourism resources;
- [3] Creating variety in tourism market, to prevent it from being seasonal;
- [4] Improving the quality of life in local communities, through their participation in projects.

In Geotourism, nature constantly by water and wind erosion is in diversity and transformation. This transformation is formed by the erosion factors, not human. The most important factors in forming the

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Earth that cause the natural phenomena to attract tourists are:

- [1] Erosions
- [2] Volcanoes
- [3] Faults
- [4] Dome and Salt crystals
- [5] Coral hills.

Water and wind erosion, change and crystallization temperature minerals, stimulants act of major erosion of the ground. Snows and rains, seasonal precipitations, waves, seas, rivers change direction, during floods, water penetration and dissolution of the layers of rocks and sediments ground lime silt, marl and sand, stone and shape and caves and underground lakes and water, water penetration rocks, freezing and destroy them, include the factors that have changed the face of a permanent nature and effects of different layers of colorful minerals reveals more land. The displacement of masses of air that brings the wind has an effective role in creating the Geotourism phenomena. Permanent streams and hurricane winds which constantly change the temperature, and increase the humidity and sometimes is dry land, transport and the displacement seeds, dust and particulate Sands and increase mental power and destructive cyclone waves, sea, including cases where the effects can have a significant influence on the destruction of low resistance sediments and the morphology of the heterogeneous brings. Rapid destruction of non-resistant strata underlying rocks, rocks of the water and wind erosion and increasing gravity force causes loss of height, drive and shape the emergence of new forms and phenomena which are varied and marvelous collection outside the will and human ability.

More than one-fifth of the area of Iran (more than 300000 Sqm) is encompassed by vast deserts. Exclusive geographical characteristics such as Lut Fantasy City, Salt Lake, Yardangs, Crystal Plains, Salt Domes, Mineral Springs, and Beautiful Karst Solutions etc have increased to the attractions of deserts of Iran. Iranian deserts enjoy unique animal life. Central deserts have been the latest habitat of Asian zebra and panther. Also, in other desert areas, unique species such as jubeer gazelle, margarita Felis, Caracal, Houbara Bustard are observed.

#### *Objective:*

The aim of the present paper is to presenting a comprehensive and clear view of natural attractions of central desert area of Iran and capabilities of Geotourism in the this area To develop several of geomorphological characteristic of for a sustainable development and to explain how to better safeguard natural richness in this area and laso suggestions and strategies for restoration of ecotourism industry and planning for optimum use of possibilities.

#### *Conceptual Framework:*

Geotourism or geological tourism is one of the specialized disciplines that introduce geological phenomena to tourists by maintaining their area identity. Geotourism uses Geomorphology, Geology, and Climatology sciences to invite Earth science interested in visiting earth attractions. Preserving valuable Earth, plant and animal species and also stabilizing local societies in macro levels are two aims of Geotourism [10]. On this basis, each local to their special geographical conditions, such as environment, vegetation and culture are visits placed in this classification.

“Jonathan B. Tourtellot” expert Geotourism scientist of National Geographic Magazine says: “Tourism sustains or enhances the geo-graphical characters of a place, its environment, heritage, aesthetics, culture, and the well-being of its residents [23].

Like ecotourism, Geotourism promotes a virtuous circle whereby tourism revenues provide a local incentive to protect what tourists are coming to see, but extends the principle beyond nature and ecology to incorporate all features that contribute to sense of place, such as historic structures, living and traditional culture, landscapes, cuisine, arts and artisanry, as well as local flora and fauna. Geotourism incorporates sustainability principles, but in addition to the do-no-harm ethic, Geotourism focuses on the place as a whole. The idea of enhancement allows development based on the feature of the place, rather than standardized international branding, generic architecture, food, etc.

#### *Method:*

This research of contribution of geomorphological assessment for sustainable Geotourism in Iran’s deserts aimed at studying the capacity for sustainable Geotourism development of the natural attractions in deserts, attitudes of tourists and stakeholders toward tourism activities in the area, and models for sustainable tourism development that involved the community, tourists, and other stakeholders. The research employed both qualitative and quantitative data collection and analysis methods; and various research instruments were used in order to obtain the most valid analysis results. The data sources for this investigation were divided into two categories: secondary and primary sources. The data were derived from academic texts, printed materials, and related research studies, and were then synthesized to obtain concepts, the theoretical framework and previous study results. Secondary data were collected and analyzed as fundamental data to be verified with the primary data later on. This type of data was collected directly from the population and sample group in the some parts of

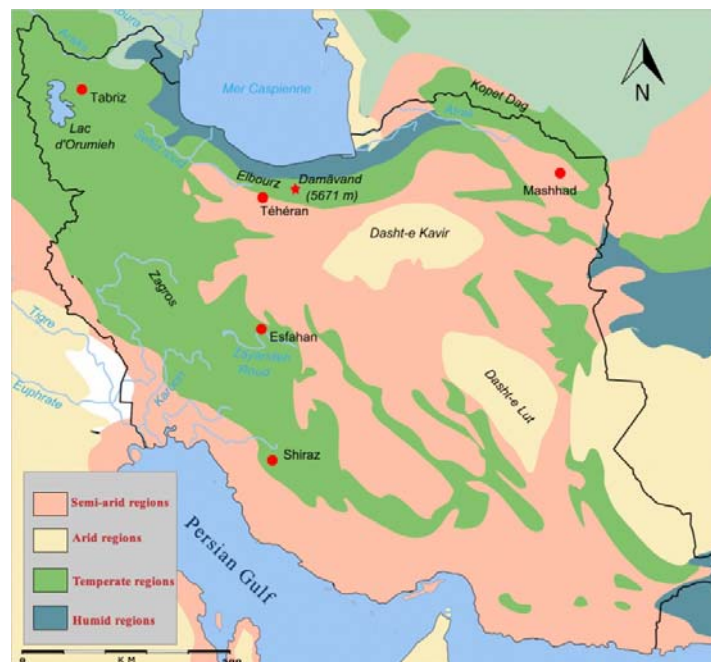
area focused on Kashan desert which located in central desert of Iran.

#### Study Area:

Geographic location and climate and dry desert winds in central of Iran have caused, to about 65 percent of the Iran vast to be in dry conditions. That in addition to desert conditions has been caused to desertification in central lands. Such conditions caused 34 million hectares of Iran surrounding by desert conditions. From this amount, 16 million hectare are sand dunes. 5 million hectares of which are shifting sands. The height of sand dunes in the desert of Iran has estimated up to 300 meters. Geographer and Environmental experts have classified the Iranian desert to various forms. Some scientists based Positions, have introduced two internal and coastal deserts, for Iran. On this basis, internal desert are continued to The Alborz and Zagros Mountains. Low with poor rainfall

distribution, high evaporation, seasonal winds, long sunny hours, difference between day and night temperature and dry climate are some features of these deserts in Iran [2]. Also the Iranian deserts are divided into two areas, First: Lut Desert and the second: Kavir desert. Other categories have been the divided desert of Iran into seven groups. Clay Desert, salt desert, permanent desert lakes, wet clay desert, temporary desert lakes, desert with Alluvial fan and Desert Clay with salt marsh.

Geographically Iran deserts are unique due to the existence of different land structures close together in almost one region; basically one can spot the salt lakes near sandy dunes. The maximum annual rainfall is approximately 100 mm there. The average altitude of this desert is almost 600 m above sea level (ASL) and the lowest point near "Khabis" is almost 300m ASL. In Kavir-e-Lut, large amount of sand is always moving southward forming sand hills and running sand masses.



**Fig. 1:** Location of Semi-arid and Arid zones, Iran.

There are two main deserts in Iran which included with some semi deserts around. Kavir-e-Lut is the largest pit inside the Iranian plateau and probably one of the largest ones in the world. Kavir-e-Lut is a pit formed by broken layers of the earth. The maximum annual rainfall is approximately 100 mm there. The average altitude of this desert is almost 600 m above sea level (ASL) and the lowest point near "khabis" is almost 300m ASL. In Kavir-e-Lut, large amount of sand is always moving southward forming sand hills and running sand masses.

Dasht-e-Kavir is a geological pit almost at the north of Kavir-e-Lut. The minimum altitude of this desert is 400 m ASL. The major part of Dasht-e-Kavir is covered by sand and pebbles and exposed to strong winds and storms that set salt-combined sand in motion like sea waves. At times, this phenomenon forms long sand hills of 40m high. From structural point of view, Dasht-e-Kavir is very much different from Kavir-e-Lut. The difference of temperature between days and nights during a year in Dasht-e-Kavir is between 0 and 70 degrees C.

*Geomorphology Assets And Attractions:*

Since two high mountain ranges are near desert lands, the volume of Eluvim entering these regions has greatly increased. Therefore the number and the height of sand dunes, which are the most varied geographical aspects of deserts is very remarkable in the deserts of Iran.

On the other hand Exclusive geographical characteristics such as Loot Fantasy City, Salt Lake, Yardangs, Crystal Plains, Salt Domes, Mineral Springs, and Beautiful Karst Solutions... have added to the attractions of deserts of Iran. Some of these futures include:

**Table 1:** The geomorphological assets and attractions of Iranian deserts.

Features	Description
Sand Dunes	In physical geography, a dune is a hill of sand built by Aeolian processes. Dunes occur in different forms and sizes, formed by interaction with the wind. These dunes are located in Lut desert. In addition this beautiful landscape is suitable for sand skiing.
Yardangs	Yardang is a wind-abraded ridge formed in cohesive material (Goudie, 2007). Yardangs may also be found in deserts and may form very unusual shapes and some resemble various objects or even people.
Nebka	Hills that are green plants on them, the spread is seen.
Imaginary Cities	By the effect of high water and wind erosion, Land in some parts would erode and in Centuries would be like ruined cities that in Iran known as Lut city and geographers have called these places as desert cities. These places are like historical cities and are so interesting.
Salt dome	A salt dome is a type of structural dome formed when a thick bed of evaporate minerals (mainly salt, or halite) found at depth intrudes vertically into surrounding rock strata, forming a diapir.
Desert Night	One of the great joys of visiting our deserts is getting the chance to see desert nights of desert and the wide variety of fauna that come to life after the sun goes down.
Desert Flora and Fauna	Iranian deserts enjoy unique flora and Fauna life. Central deserts have been the latest habitat of Asian zebra and panther. Also, in other desert areas, unique species such as jubeer gazelle, margarita Felis, Caracal, Houbara Bustard are observed and also unique species of desert plants Alhagi, Salsola, Calligonum and Tamarix.
Salt polygons	A surface of salt on a playa, having three to eight sides marked by ridges of material formed as a result of the expansive forces of crystallizing salt, and ranging in width from an inch or so to 100 feet.
Salt Lake	Salt lakes or saline lake is a landlocked body of water which has a concentration of salts (mostly sodium chloride) and other minerals significantly higher than most lakes (often defined as at least three grams of salt per liter).
Mineral Springs	Desert Hot Springs is home to a number of hot mineral water spas.
Karst Solutions	Karst solution is among the most significant of geomorphologic processes and has produced excellent dolomite e pavement as well as fluvio-karst and holokarst features. (Cowel 1978)



**Fig. 3:** Yardang formation, Shahdad, Iran.



**Fig. 4:** Salty Polygons formation, Kashan, Iran.



**Fig. 5:** Plant species of Tamarix.



**Fig. 6:** Plant specie of Calligonum.

*Operational Status of the Iranian Desert:*

In recent years in desert tourism in Iran has had good growth, according to unofficial statistics, tourism organizations between 1997 to 1999 annual average of five tours in the desert areas has been held that participants in the countries of central Europe often tourists like Belgium, Switzerland, Austria, Netherlands and other industrialized countries such as Japan and Canada have.

But surely immense resources in comparison with what is leading to exploitation of these resources is done in Iran emphasizes that Iran has not yet started in the wilderness yet. In the area of a small country such as Tunisia, the desert tourism of the five percent less, according to the coastal wilderness of the country that primarily are considered semi-arid desert and not real wilderness during the past decade have increasingly been able to much now Annual Capacity to reach three billion dollars.

It seems that the lacks of development in desert tourism in Iran are the following factors:

- [1] Almost there is no activity to identify the deserts tourism and attractions.
- [2] For desert tourism in Iran, there is no booklet or guide map.
- [3] Facilities are not provided for desert tours. Reconstruction is not performed for desert Caravansary.

*Policies And Planning:*

Discovery of oil in early twenties was significant in characterizing the state in Iran. State's source of income has changed to the oil/petrol revenues paid in foreign exchange directly to the state. Oil/Petrol revenue was supposed to be an engine of growth; yet easy access to its exchange rate eventually inhibited the development of agriculture, industry and all other productive activities and "promote a reliance on import, services, and speculative activity rather than long-term investment". So, Iran's economy mainly based upon exporting raw oil/petrol which is about 85% of annual budget of the country. As a result, government as a monopolized owner of oil resources

pays the least attention to other sources of income which can be considered in long term policy making and development planning. Additionally, government's political and social spastic approach and policy reduce the trend toward international investment in tourism development in Iran and consequently cause an obstacle in order to entrance the international tourism market. Other difficulties, directly or indirectly, emerged from this neglection are as follows [9].

*Infrastructure:*

Centralized state system in Iran resulted in an unequal infrastructure development. On the one hand, big cities such as Tehran, Isfahan, Tabriz and Shiraz are fairly developed and modernized; on the other hand, many other regions and cities remained marginalized and deprived. Roads and railways do not go far in accordance with the developmental needs; rather they go according to big cities requirements. As it has been mentioned above, tourism is not seen as a development priority in national development planning and again it was said that there is no noticeable, neither public nor private, investment in tourism; hence, appropriate accommodation facilities are insufficient. Moreover, in spite of long distance between tourist destinations, tourist services such as restaurants, sanitation services and so on are very limited. Iran has not developed its banking and financial system with regards to tourism, particularly international tourism requirements. There are few foreign exchange centres and almost no possibility of international money facilities such as credit card, foreign exchange cash machine, electronic banking and alike [9].

*Cultural Situation:*

Notwithstanding tourism potentials have been naturally distributed all around the country, it does not mean that all local communities are ready and prepared to welcome tourists. In explaining that, it is to say that as the idea of change has not been experienced directly (like what happened in Western

societies); traditional societies have a low capacity for identification with new aspects of their life. Traditional society “develops few requiring economic interdependence; lacking the bonds of interdependence, people’s horizons are limited by local and their decisions involve only other known people in known situations” [8]. In other words, local communities are not open to tourism and changes brought by it or even in worst case scenario they might be hostile. One can see this attitude as a result of lack of information and education about tourism and its positive contribution to the region’s development. Furthermore, it is remarkable to say that ‘non-participant’ is predominant characteristic of local communities and they are hardly ever up for alteration due to general weakness of civil society and lack of NGOs.

Apart from those communities which do not welcome tourist, areas that do so will be affected in other way. “Using cultural values at the wrong place, wrong time with the wrong standard has created in turn a misleading and damaging image about local communities in those tourist destinations. Overtime, it may become increasingly difficult to discern differences between commercially inspired and authentic cultural shows” [11].

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In desert areas the ways of desert life continue to survive, despite the fragile balance they require and threats to the social ties that underpin them. As the

desert's principal resource, culture both tangible and intangible warrants particular attention [13].

Tourism can significantly affect and ultimately destroy these ways of life:

- [1] through a lack of respect for traditional ways of life;
- [2] through highly competitive pricing and inequitable distribution of the economic benefits of tourism;
- [3] through the looting of archaeological sites, the removal of artifacts required to properly understand them, and the degradation of rock-art carvings and paintings;
- [4] through excessive visitor traffic and overcrowding, leading to the deterioration of sites;
- [5] through an artificially folkloric treatment of culture and a society's intangible heritage.

#### *Environmental Situation:*

Environment and ecological balance were influenced by tourism development in many regions. The possibility of quick profit of tourism industry is tempting especially in environmentally good but economically poor areas; however, overuse of resources is a serious threat. Since there is no comprehensive national plan and monitoring for tourism development, in some cases local authorities make decisions on their own disregarding the environmental issue and long-term viability of resources. Pollution is also another environmental matter at popular tourist destination “due to lack of measures to cope with the generation of new or increased waste residues” [11]. The carrying capacity of sewage disposal systems has not been exceeded in accordance with tourism growth and increased number of hotels and services. Air pollution, overcrowding, traffic jam and noise can be mentioned as other discomforts, especially for local people.

If ecotourism is properly managed and planned, it will bring numerous economic resources for the government, private sector, and local groups and societies and could help improve living conditions of people and changing quality of lifestyle in rural environments. Some benefits are.

- [1] Employment Creation,
- [2] A Stronger Economy,
- [3] Environmental Education,
- [4] Improved Conservation Efforts.

Besides positive effects, negative effects of tourism must also be considered. Particularly in areas surrounding arrival points, attracting the neediest population to peripheral urban areas, spawning shantytowns, and generating unhealthy living conditions with all the attendant consequences lack of proper health care, drinking water, and waste management facilities.

Also local tourism actors, moreover, are prepared to accommodate only so many tourists; when their capacity is exceeded, the result can be

poor service and tensions within the host community. Also, given the fragility of desert ecosystems, there is a threshold of tolerance beyond which tourism can produce significant negative impacts. Desertification is part of the context in these areas, and tourism should not have the effect of aggravating it. Soil degradation is synonymous with famine and poverty. To find other means of subsistence, populations living in regions threatened by desertification have been forced to move on, and such population movements are among the major consequences of desertification.

Desert spaces are still relatively well preserved today. The aim now is to anticipate the impact of tourism, which could otherwise prove destructive for these territories over the long term. It's therefore important to begin by identifying modalities for the sustainable development of these unique ecosystems so as to preserve this universal heritage for present as well as future generations and improve living conditions for local populations. The latter should be actively involved in their own development and derive benefit from tourism activity [13].

[1] Decline of rare or spectacular species through hunting, vehicle accidents, capture and killing of rare animals for souvenirs, keen wildlife tourists prefer to seek out rare or spectacular animals for observations and photos which increases stress on them.

[2] Habitat alteration/destruction through road, track, campsite and lodge construction and vegetation clearing in order to provide better views for tourists.

[3] Unnatural concentrations of wildlife through establishment of artificial assistance like water holes and salt licks and inappropriate waste disposal and dumping places which are easily accessible for wild animals.

[4] Habitat destruction/alteration through road and camps construction.

[5] Eutrophication caused by soaps, detergents and human fecal material.

[6] Soil contamination through burying of non-biodegradable litter such as glass bottles, aerosol cans, batteries and plastic bags.

[7] Reduced plant density and decrease in biomass through trampling road construction.

[8] Mechanical damage on vegetation through removal of twigs and branches along tracks and camps [15].

#### *Discussion:*

Iran is a big country with long coastal lines in North and South, plains in North and West, central deserts surrounded by mountain ranges. This geographical diversity formed diverse climate, ecology and biology within the country. In addition to this ecological variety, there is a history of three thousand years of civilization which results a cultural diversity or in better words a mosaic of different ethnicities and different life-style and mode of

production such as nomadic mode of production, rural one or modernized industries. An infrastructure network of roads, railways and airlines as well as energy and communication networks are connecting this, sound to be paradoxical, ecological and cultural diversity. So there is a strong probability for tourism in Iran. A quick glance over the history of tourism in Iran reveals the existence of tourists in all historical periods and also in contemporary era Iran is attractive for international tourists specially those were interested in history and archaeology [16].

The typology of tourism in Iran is as following, (a) Ecotourism: As it was mentioned Iran is a land of ecological diversity; coastal line in North and South, mountain ranges and peaks and lagoons, central deserts, rivers and forests, (b) Tourism of history: historical monuments from two thousand B.C., palaces and sites remaining from Achaemenid like Persepolis and Pasargad, Sassanid and Islamic architecture, (c) Cultural tourism: different ethnicities and culture provides a wide range of anthropological attractions such as way of men and women dressing in different areas, local music, local food and diverse handicrafts like carpet, ceramic and silver. (d) Rural and agriculture tourism: geographical diversity of the country formed different type of rural life, for example households and agricultural landscape, which varies in each area.

(d) War tourism: in spite of all reconstruction of area damaged during the Iran-Iraq war; many areas remained untouched which provides good chance for documentation to whom might be interested, (e) Medical tourism: there are two types of medical tourism in Iran. One is technological advanced hospitals and professional and well-skilled doctors, especially in organ transplant surgeries that mark Iran as a superior country for countries of the region. Second type of medical attraction for tourism is related to natural resources such as hot mineral water springs and relaxing resorts.

As a result of having diverse climates, various geological features and typical diverse habitats, Iran has geographical (geotops) and natural phenomena such as mountains, caves, straits and valleys, vast forests, huge geological fissures, ponds and lakes, mud volcanoes, sandy pyramids, cliff-rocky shores, ancient mines and etc which as geological heritages in the form of numerous geo-parks they may be considered a functional tool for in tourism development. Some of these Geotourism sites are as follow:

#### *Conclusion:*

Iran has been known as one of the 59 Biosphere Reserves having 1880 kilometers of coastlines in Persian Gulf and Gulf of Oman and 630 kilometers of coastlines in Caspian Sea, benefiting from mountain and forest perspectives with various kinds of climate as well as full biological variety. Moreover, we can point to its broad deserts which

have many desert components, such as wind blowing, quicksand, the maximum temperature has been registered in highest limitation as well as thousand years of various spectrums of living, rural and nomadic customs in conformity with climatic conditions are considered as part of Geotourism areas which can be effective in tourist attraction. Desert tourism, especially for the inhabitants of European Countries who are deprived from this natural biome, is considered as one of the highly attractive tourism fields. Unique perspective of deserts, which has been ornamented by quick dunes, flora and fauna, unique vision and peace, difficulty and intensity of climatic conditions and consequently much temperature difference between day and night, historical memories and adaptations of human life in desert during elapse of time, has made the desert one of the unique attractions of the nature and has concluded that the tourists would be interested in visiting desert and experiencing its climate. Even some of adventurous tourists have commenced adventurous travels for themselves by accepting many difficulties for passing from broad deserts and endurance of hard conditions of desert. Nowadays, in some countries such as Tunis, the income of desert tourism is up to 3 billion dollars per annum. (Resource: The comparison of income share of geo-tourism and mine in China and Tunis and study of desert tourism potential in Iran, Iranian Geology Organization, National Iranian Base of Geological Data, 2006). The prosperity of desert tourism not only results in economic output for broad spectrum of the country which has no productive, agricultural and industrial competitive capabilities, but also it revives some of forgotten traditional customs, such as camel riding, and helps the improvement of life quality of local communities.

Iran could develop tourism planning, especially Geotourism, to achieve sustainable development. Some of the beneficial consequences of sustainable development Geotourism desert areas are:

- [1] By creating employment Geotourism can be effective in fighting poverty.
- [2] Creating partnership between host community and sharing the benefits of tourism.
- [3] Promoting cooperation among different sectors of industry and as a result environmental protection.
- [4] Employing local people and their participation in tourism development can help them.
- [5] Using local products and crafts to keep cultures also make sustainable jobs.

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