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Environmental impacts assessment (EIA) of tourism development on the range overlooking Hamadan city in Iran

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Abstract. Identification and audit of tourism development activities for identification and determination of environmental impacts and consequences, is of important matters in the field of sustainable tourism development. Tourism development sustainability in mountainous areas is particularly important due to the existence of natural risks which are sometimes intensified by mankind. In this study, the northern range of Alvand overlooking Hamadan city and its surrounding areas with an area of 698.8 square kilometer have been studied for the analysis of tourism development processes and environmental impact assessment (EIA). EIA is one of important methods for achieving sustainable development and is one of important management, planning and decision making tools. In this research, in this research, by collecting field data and laboratory information and performing studies, the positive and negative physical, natural and socio-economic impacts resulting from tourism development in the capital ranges of Hamadan city (in implementation and exploitation phases) on the environment have been identified. Also, the EIA has been performed using Iranian matrix, and the results obtained suggest that sustainable development of tourism in these areas can be possible through correctional measures and development plans.

Keywords: Environmental impact assessment (EIA), tourism development, Iranian matrix, Hamadan (city)

1. INTRODUCTION

Until late 1970s, tourism has been introduced as a golden and clean activity whose optimal consequences and benefits and more particularly, economic benefits had always been emphasized (Choi: 2003, 77). Since the 1980s, several research findings and reports have emphasized the negative environmental, social, cultural consequences of tourism. In that decade, environmental consequences resulting from development had become the only concern of this field's researchers (Butler, 109-, 5). In the 1990s, in alignment with sustainable development paradigm, traditional approaches of tourism have been challenged, and by the simultaneous emphasis on the desirable and undesirable consequences of tourism, a transition from mass tourism to sustainable development of tourism began (Jurowski, Williams & Uysal: 1997,3). In sustainable development of tourism, while paying attention to tourism as a key factor in national and regional development, its possible consequences for the social and cultural characteristics of local community and environmental capacities and natural resources are considered. Here, the EIA of development plans is one of the methods accepted for the achievement of sustainable development and can be provided to planners, managers and decision makers as an accessible tool, so by using it, they can identify potential environmental impacts which appear as a result of implementing civil and development projects, and select logical options for their elimination or reduction. EIA is a process that can be used to identify the environmental aspects and impacts of various projects before they're implemented and develop and revise technical (structural) or managerial (non-structural) approaches for the reduction, control, compensation of negative impacts or strengthening of positive impacts. Using this process and tools, a plan's long term sustainability will be guaranteed and it will be ensured that the plan will not destroy the environment or reduce its environmental quality in an irrecoverable way. Currently, development of tourism, as an effective approach for regional development and enjoying characteristics such as employment and beneficial, is considered by authorities and planners. Therefore, Hamadan city is considered

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by the corresponding authorities for this purpose because it has natural tourism attractions such as Mount Alvand that is one of Hamadan province's natural and attractive features and has tourism potentials such as mountains with green and deep valleys, springs, lawns, hills and vegetation, etc. that is the meeting point of thousands of nature enthusiasts. Since natural environments always change, and this change is more intense in mountainous regions and particularly mountain ranges, and sometimes this change is intensified by humans, hence, EIA under such conditions is important for prevention of natural risks. Since Iranian matrix is a way for the assessment of the impacts of an activity on a phenomenon or process, the researcher of this paper has used it for the EIA of tourism development of the ranges overlooking Hamadan.

2. INTRODUCTION OF THE REGION UNDER STUDY

The region under study has an area of 2745 square kilometers and is located in the northern range of Alvand (central highlands of Hamadan province) at area of east longitude and at to area of northern latitude, in the central Zagros range (figure 1). The stones in the region are intrusive granite, shale, slate and schist of Jurassic period (figure 2). According to Asadabad station meteorological statistics (1997-2007), the average annual temperature of the region is +10/75C^0 which vary from minus 15 to plus thirty four during winter and summer. The coldest and hottest months of the year are Bahman (around February) and Mordad (around August) (Iranian months), respectively. The average annual rainfall of the region is 443.11mm. Generally, the region's climate based on Emberger method is intermediate semi-arid and sub-humid cold.

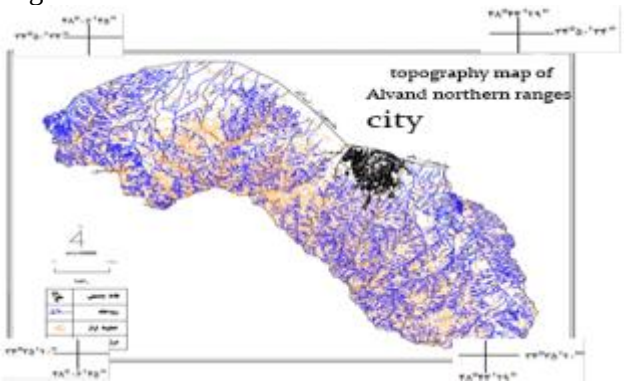


Figure 1. Geographical location of the region under study and Hamadan city.

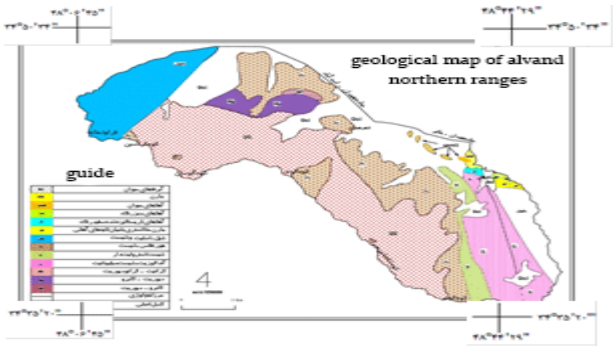


Figure 2. Geological map of the region under study.

3. THEORETICAL FOUNDATIONS

Iranian Matrix: Iranian Matrix (IM) is a method for the assessment of the impacts of an activity on a phenomenon or process. With IM, the impact of each activity in a plan on various and related phenomena is identified and evaluated. At the end, by a mathematical computation of these impacts, it's possible to discover the negative impact level of a plan on these phenomena and make

decisions for the possibility of its implementation accordingly. Of the characteristics of this method is that at the end, the plan's activities that are harmful for the phenomena under study will be investigated and the impact level of these phenomena will be specified. It will also be specified, which one of the factors of the phenomena under study, will receive the greatest damage from the implementation of this plan.

The application of IM in tourism planning: In tourism planning, IM is used to determine the impact of tourism development on environmental, social, economic, cultural, infrastructural, etc. factors. For a better understanding of these impacts, we focus on some basis definitions:

Basic definitions

- **Impacts of tourism development**: it's a group of changes and processes that can take place during tourism development in a region. In other words, these changes are a part of tourism development.
- **Consequences of tourism development:** it's a group of characteristics and indexes that change under the impact of tourism development and can be strengthened or weakened.

EIA method with the use of IM

EIA is one of important methods for the achievement of sustainable development and of important management, planning and decision making tools. In Iran, EIA began since 1976, but it emerged since 1980 (Makhdum,1983:27). In spite of this, with the approval of the Supreme Council of Environment in 1994, EIA found a place in executive agencies and above all in the scientific bodies and consulting engineers. However, after three decades of the executive and scientific history of EIA, there are still some ambiguities for some assessors, and there are contradictions in their comments. Some assessors are so involved in assessment that they have neglected the scientific world of EIA, especially after the use of modern technologies. Also, in the assessment of protected regions, there's still some dissidence between protection and support. Generally, the dimensions under study for environmental impacts in all plans happens as below in four parts:

A) Environmental impacts on physical environment:
1- Impacts on soil: morphological and qualitative
2- Impacts on water: water quantity and quality
3- Impacts on climate, weather and sound: changes in the weather and rainfalls, weather quality
4- Secondary impacts between water, weather and soil.

B) Environmental impacts on natural environments:
1- Impacts on plant species
2- Impacts on animal species
3- Impacts on habitats, landscapes and bird migration routes.

C) Environmental impacts on social and cultural environments:
1- Impacts on public health and environmental health
2- Impacts on social environments: employment, housing and education
3- Impact on cultural environment: cultural and religious beliefs of people, cultural heritage.

D) Environmental impacts on development plans:
1- Impact on other agricultural, industrial and service plans of the region
2- Impact on region preparation
3- Impact on region's land use

This model and 8 notes have been approved at an environment council meeting held in 2008/22/01 (Monavari, 2001: 76-77).

4. METHODOLOGY

Stage1: tourism development impact assessment

At this stage, a list of tourism development impacts on the executive region will be prepared. For this purpose, Delphi technique or expert comments can be used.

Stage2: Tourism development consequences assessment

At this stage, a list of tourism development consequences for the executive region will be prepared. For this purpose, Delphi technique or expert comments can be used.

Stage3: assessment

At this stage, each individual impact on each consequence will be determined. This assessment is as follows.

Impact type	Level of impact
Positive	Ranging from 1 (lowest) to 5 (highest)
negative	Ranging from -1 (lowest) to -5 (highest)
No impact	zero

Stage4: Matrix formation

At this stage, we will form a matrix as follows:

Matrix columns: we place the impacts as independent variables in the matrix columns.

Matrix rows: we place the consequences as dependent variables in the matrix rows.

Matrix elements: impact level on consequences, e.g. a_{ij} equals the impact of j on the index of i (the impact level of the consequence resulting from j on the index of i). The resulting matrix will be as follows:

$$A=[a_{ij}]_{m\times n}=\begin{array}{c} \begin{matrix} X_1 & X_2 & \cdots & X_n \end{matrix} \leftarrow \text{impact} \\ \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix} \begin{matrix} A_1 \\ A_2 \\ \\ A_m \end{matrix} \\ \uparrow \text{consequences} \end{array}$$

Stage 5: assessment table formation

According to the matrix obtained at stage four, we adjust the assessment table as follows:

ratio of total positive consequences to total impacts (final value of impacts)	total positive impacts	total positive and negative impacts	X_n	. . .	X_2	X_1	impacts / consequences
			a_{1n}	. . .	a_{12}	a_{11}	A_1
			a_{2n}	. . .	a_{22}	a_{21}	A_2
			⋮		⋮	⋮	⋮
			a_{mn}	. . .	a_{m2}	a_{m1}	A_m
							total positive and negative consequences
							total positive consequences
							ratio of total positive impacts to total consequences final value of) (impacts

Stage 6: Beneficence or disadvantage level determination of each impact and consequence

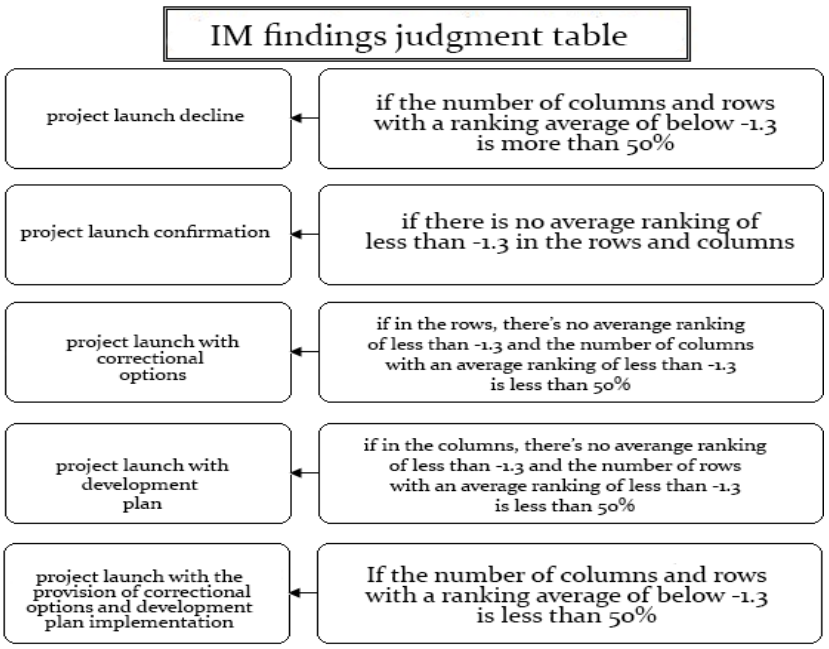
The final value of each numerical impact or consequence ranges from -5 to +5, whose beneficence or disadvantage will be specified according to the table below:

Final value	Disadvantageous	Final value	Beneficent
Between -4 to -5	Very much	Between +4 to +5	Very much
Between -3 to -4	Much	Between +3 to +4	Much
Between -2 to -3	Medium	Between +2 to +3	Medium
Between -1 to -2	Little	Between +1 to +2	Little
Between 0 to -1	Very little	Between 0 to +1	Very little

Stage 7: Calculate the average ranking of rows and columns
The average ranking of rows and columns will be calculated as follows for the assessment of the final results in the IM table:

average of total consequences average ranking of rows	total number of positive and negative consequences	X_n	. . .	X_2	X_1	impacts / consequences
		a_{1n}	. . .	a_{12}	a_{11}	A_1
		a_{2n}	. . .	a_{22}	a_{21}	A_2
		⋮		⋮	⋮	⋮
		a_{mn}	. . .	a_{m2}	a_{m1}	A_m
						total number of positive and negative impacts
						average of total impacts average of columns ranking

Stage 9: Determining the final result
According to the IM judgment table, the final decision to continue the process of tourism development is as follows:



5. ANALYSIS

IM technique stages for the assessment of tourism development in northern ranges of Alvand:
Stage 1: Tourism development impact assessment
At this stage, we prepare a list of tourism development impacts on the executive region. For this purpose, Delphi technique or expert comments can be used.

impacts	Various environmental impacts
X1) change in land shape and appearance. X2) Ranges cutting. X3) underground water resources pollution. X4) Ecological changes. X5) change in soil physical quality change. X6) Pasture destruction.	Physical
X7) Destruction of some plant species. X8) Habitats destruction. X9) Change in landscapes.	Natural
X10) Creation of job opportunities. X11) increase of non-indigenous inhabitants. X12) Quality improvement of infrastructures. X13) Increase in foreign investment.	Social and cultural

Stage 2: Tourism development consequences assessment
At this stage, we prepare a list of tourism development consequences for the executive region. For this purpose, Delphi technique or expert comments can be used.

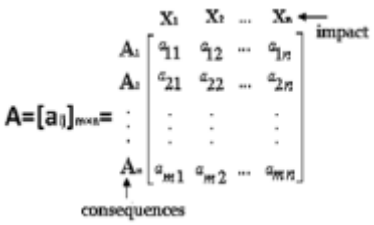
consequences	Various environmental consequences
A1) wastewater and sewage production. A2) Creation of air and noise pollution. A3) production and accumulation of wastewater and waste. A4) improvement of communication paths. A5) Slipping and sliding caused by mountain cut. A6) Increase of erosion. A7) range movements.	Physical
A8) changes in the habitats of animals. A9) change in animal species. A10) landscape destruction.	Natural
A11) social acceptance and increased social participation. A12) Improvement of indigenous people life quality. A13) employment and profit making. A14) welfare. A15) increased knowledge and technology. A16) change in the region's migration process.	Social and cultural

Stage 3: Assessment

At this stage, the impact level of each impact on each consequence will be specified. This is done as follows:

Impact type	Impact level
Positive	Ranging from 1 (least) to 5 (highest)
negative	Ranging from -1 (least) to +5 (highest)
No impact	zero

Stage4: Matrix formation
At this stage, we form a matrix as follows:
Matrix columns: we set impacts as independent variables in the matrix columns.
Matrix rows: we set consequences as dependent variables in the matrix rows.
Matrix elements: impact level of impacts on the consequences, e.g. a_{ij} equals the impact level of j impact on the index of I (impact level resulting from the impact of j on the index of i). The resulting matrix is as follows:



Stage 5: Formation of assessment table

Given the matrix obtained at stage 4, we arrange the assessment table as follows:

Final value of consequences	Algebraic sum of impacts	Total number of impacts	X13	X12	X11	X10	X9	X8	X7	X6	X5	X4	X3	X2	X1	impacts / consequences
+1	+2	2	0	+5	-3	0	0	0	0	0	0	0	0	0	0	A1
0	0	2	0	+3	-3	0	0	0	0	0	0	0	0	0	0	A2
+1	+2	2	0	+5	-3	0	0	0	0	0	0	0	0	0	0	A3
+3.25	+13	4	0	+5	0	0	+3	0	0	0	0	0	0	+3	+2	A4
-3.57	-25	7	0	0	0	0	-4	0	-1	-3	-5	-3	0	-5	-5	A5
-4	-28	7	0	0	0	0	-5	0	-2	-4	-5	-2	0	-5	-5	A6
-4	-28	7	0	0	0	0	-4	0	-1	-5	-5	-3	0	-5	-5	A7
-4.50	-36	8	0	0	0	0	-5	-5	-4	-5	0	-5	-3	-4	-5	A8
-3.75	-30	8	0	0	0	0	-4	-5	-3	-5	0	-5	-2	-3	-3	A9
-4.50	-36	9	0	0	0	0	-5	-3	-5	-5	-4	-3	-2	-5	-4	A10
+3.67	+11	3	+3	0	+5	+3	0	0	0	0	0	0	0	0	0	A11
+2.80	+14	5	+4	+5	0	+5	0	0	0	0	0	0	-1	0	+1	A12
+1.80	+9	5	+4	0	+1	+5	0	0	0	-3	0	0	0	0	+2	A13
+2.60	+13	5	+3	+5	0	+5	0	0	0	0	0	0	-1	0	+1	A14
+2.50	+10	4	+2	+4	+2	+2	0	0	0	0	0	0	0	0	0	A15
+1.75	+7	4	+2	+2	0	+5	0	0	0	-2	0	0	0	0	0	A16
			6	8	6	6	7	3	6	8	4	6	5	7	10	Total number of consequences
			+18	+34	-1	+25	-24	-13	-16	-32	-19	-21	-9	-24	-21	Algebraic sum of consequences
			+3	+4.25	- 0.17	+4.17	- 3.43	- 3.34	- 2.67	- 4	- 4.75	+3.50	+1.80	- 3.42	- 2.10	Final value of consequence

Stage 6: Beneficence or disadvantage level determination of each impact and consequence

The final value of each numerical impact or consequence ranges from -5 to +5, and the table below shows the beneficence or disadvantage of them:

Final value	Disadvantageous	Final value	Beneficent
Between -4 to -5	Very much	Between +4 to +5	Very much
Between -3 to -4	Much	Between +3 to +4	Much
Between -2 to -3	Medium	Between +2 to +3	Medium
Between -1 to -2	Little	Between +1 to +2	Little
Between 0 to -1	Very little	Between 0 to +1	Very little

Beneficence or disadvantage level determination of each impact

Beneficence or disadvantage level of each impact and consequence	Final value of impact	Impact
Disadvantageous – medium	-2.10	X1
Disadvantageous- much	-3.42	X2
Beneficent- little	+1.80	X3
Beneficent- much	+3.50	X4
Disadvantageous – very much	-4.75	X5
Disadvantageous- much	-4	X6
Disadvantageous – medium	-2.67	X7
Disadvantageous – very much	-4.34	X8

Disadvantageous- much	-3.43	X9
Beneficent- very much	+4.17	X10
Disadvantageous – very little	-0.17	X11
Beneficent- very much	+4.25	X12
Beneficent- medium	+3	X13

Beneficence or disadvantage level determination of each consequence

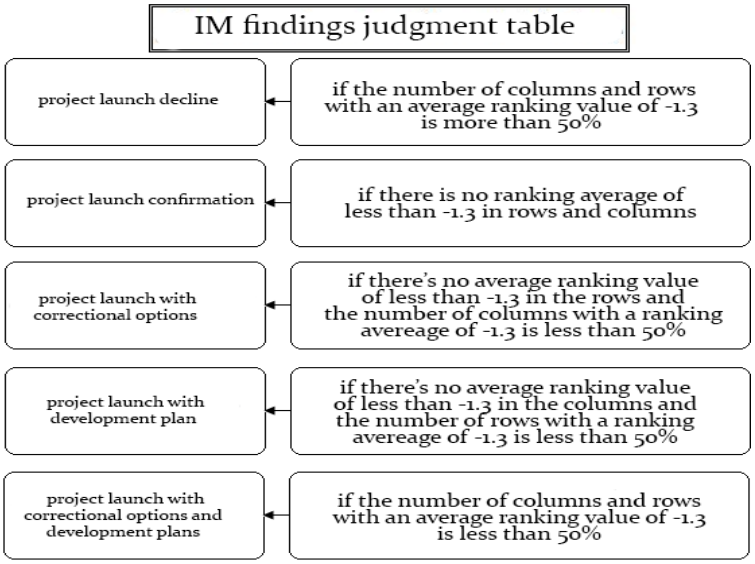
Beneficence or disadvantage level of each consequence	Final value of consequences	Consequences
Beneficent – little	+1	A1
Disadvantageous – very little	0	A2
Beneficent – little	+1	A3
Beneficent - much	+3.25	A4
Disadvantageous – very little	-3.57	A5
Disadvantageous – very much	-4	A6
Disadvantageous – very much	-4	A7
Disadvantageous – very much	-4.50	A8
Disadvantageous –much	-3.75	A9
Disadvantageous – very much	-4.50	A10
Beneficent- much	+3.67	A11
Beneficent – medium	+2.80	A12
Beneficent – little	+1.80	A13
Beneficent – medium	+2.60	A14
Beneficent – medium	+2.50	A15
Beneficent – little	+1.75	A16

Stage 7: Calculation of the number of rows and columns whose final value is below -1.3.

6	The number of rows whose final value is below -1.3
7	The number of columns whose final value is below -1.3
13	Sum

Stage 8: Determining the final result

According to the IM judgment table, the final decision to continue the process of tourism development is as follows:



According to the IM judgment table, the final decision to continue the process of tourism development is to launch project with correctional options and development plans.

6. CONCLUSION

According to the results obtained from the IM, the continuity of the process of sustainable development of tourism in the northern ranges of Alvand is possible with the provision of correctional options and implementation of development plans. For this purpose, during the project, monitoring plans will be essential and should be implemented in a way that provides the information required for the determination of environmental conditions and makes the prediction of future impacts and consequences possible. However, given the diversity of tourism, plans and activities in this sector including sustainable development of tourism, requires interaction with corresponding sectors. Sustainable development of tourism is obtained when these related sectors act in a coordinated, complementary and supportive manner. Also, measures such as environment protection and training a host community and tourists for the protection of the environment and culturalization and creation of local participation are of approaches influencing the process of sustainable tourism development.

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