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Evaluation of the Environmental Impact of Khurshid Park through Rapid Impact Assessment Matrix (RIAM)

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Abstract
Environmental impact assessment is a tool to ensure the proper and correct implementation of a project, and it can be considered as a way to determine, predict and interpret the effects of a proposed project on the environment. In the process of assessing the effects of the environment, human judgments have always been effective in making decisions and with choosing the type of use or measuring the impact of developments on the environment. In the present study, the environmental effects of Khurshid Park have been investigated through the rapid impact assessment matrix (RIAM). The matrices have been scored by experts in this field and their results have been presented through Pastakia model formulas in the form of a range of quantitative and qualitative changes. The result is that the negative effects of the project in the construction and exploitation phases are especially evident on the biological environment, so the implementation of environmental management and monitoring program is necessary for the project, and if there is the decrease in theof negative effects of the project in the construction phase and given the positive effects of the project in the eExploitation phase, the project is feasible and will have positive and beneficial effects in the short and long term onin the region. At the end of the research, environmental observation suggestions and solutions are presented to reduce the negative effects of Khurshid Mountain Park Mountain.

Keyword: *Environmental Impact Assessment, Rapid Impact Assessment Matrix (RIAM), Khurshid Park*

1.Introduction
The construction of the promenades will provide the ground for the tourism industry and will contribute significantly to the region's economy. The creation of any industry affects the environment of that the region, so environmental impact assessment can play an effective and important role in identifying the possible effects of developments on the environment and reducing environmental problems and participatingon in sustainable development (Monavari, 2008: 33). Environmental impact assessment is an important management tool for human use of the environment through a systematic and public process that is used to identify and design sustainable environmental development projects, programs, and plans (Tavakoli, 2017: 149), also as a planning tool, it identifies the possible positive and negative effects of a project on the environment and helps decision-makers to reject or accept a project by providing a reasoned basis (Parastar, 2012: 1). In this the current research, the desired area of Bustan Khurshidthe area under study is Khurshid Park, with an area of about 384 hectares is located in District 9 of Mashhad Municipality, which is being constructed in terms of location between the residential area south of the Vakilabad axis and the 75-meter beltway under construction. Topographically, the Khurshid Park has a variety of topographiesy and most of its lands are located on a slope of more than 30%. This park can play an important role in the development of tourism in Mashhad and meet responds to the service and welfare needs of its surrounding area. Construction and operation of such parks (Park Mountain) have potential effects and consequences such as water, soil, noise, air pollution, and the dangers of transporting harmful and dangerous substances. On the other hand, the use of land to create parks, numerous recreational spaces, and highways may conflict with the current uses of the environment, having and have a detrimental effect on neighboring ecosystems. Therefore, the development and improvement of the quality of life should be accompanied by environmental considerations. Before trying to find a solution to the problems created, such problems should be prevented as much as possible (Shariat, 2011: 115). OConsidering that one of the reasons why the environment has been misused by mankind is tourism and especially ecotourism. In fact, the negative effects of tourism on nature include air pollution because of the increase in traffic, water

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pollution caused by leaving solid trash in the water by tourists or soil pollution triggered by the spread of garbage. Taking into account the importance of mountain parks and their adverse effects on the environment, the primary purpose of evaluating environmental effects is to eunsure of regard aboutthe observance of policies and assigned goals in the program and activities of a project in accordance with environmental terms, standards, laws and regulations of the government, and the intent of this study is to identify the important activities of Khurshid Park in the construction and exploitation phase to determine its disadvantageous effects and consequences on the natural environment (southwestern heights of Mashhad). Considering the environmental results effects, how would saidhow does the aforesaid project affect the environment, in case of being executed or not executedion or otherwise? Evaluating the effects of development is a way to show the negative and positive effects of a project and thus a tool for proper planning and optimal management. Regarding the implementation of construction projects that bring the environment in line with development, a program is needed to combine the possibility of implementing these projects with environmental considerations (Monavari, 2013: 58).

2. Theoretical Foundations

2.1 Environmental sSustainability tability

With the occurrence emergence of environmental waste and the decline in the general standard of living of people, especially in urban communities over the past decade or two, the sustainable development approach has been raised as a topic of the last decade of the twentieth century by the United Nations and was has been determined as the twenty-first-century instruction at the international, regional and local levels. In other words, the principle of sustainability is emphasized in development plans and programs as a general goal; a goal that has no end and is continuous. The term sustainable development was first coined by the World Commission on Environment and Development in 1987. The commission focused on environmental issues in the process of economic development. The most accepted definition of sustainable development is given in the Brantland Report. According to this report, sustainable development is a development that recognizes the needs of the present generation without compromising the ability of future generations to meet their needs (Hatami Nejad, 2016: 50). Sustainable development emphasizes the creation of a dream society, superior to today's society, and strives to make it a reality for future generations. The sustainability process is multidimensional (Pourjafar et al., 2011: 26), which is based on three main principles: 1. Ecological sustainability: This principle is based on development by preserving basic environmental processes, biodiversity, and environmental protection. 2. Cultural and social sustainability: This principle emphasizes the control of people over their destiny during development.3. Economic sustainability: This principle emphasizes the optimal use of resources and their proper management as a way that future generations do not have problems (Mahmoudi and Majed, 2012: 44).

2.2 Environmental Impact Assessment

Assessing the effects of development on the environment is now considered as a planning and decision-making tool that predicts the effects and consequences of project implementation on the environment. Environmental impact assessment is the process and method of reviews and formal studies to predict the effects of project activities and functions on the environment, human health, and social welfare, or in other words, the systematic identification and evaluation of the consequences effects of projects and programs and plans on physical, chemical, biological, cultural, economic and social components of the environment. (Yousefi et al., 2012: 2). The process of environmental impact assessment is established, in the first place, to help the proper sustainable development planning and then to expand existing development projects (Dastorani, 2009: 1). There are various methods for preparing an environmental impact assessment report for a plan or project, such as a matrix checklist, overlaying maps, and a systematic analysis method. Almost all of these methods are common in four basic stages, which include: understanding the project and its main activities in the implementation and operation stages, understanding the environment (physical, biological and socio-economic environment), evaluating and predicting the effects of the project on the features of the environment and managing the actions to reduce significant negative predictable impacts and which finally, implementing a the monitoring and management program should be implemented to reduce the negative effects (Bahrman; 2017: 129). Examination of the history of a selection of evaluation methods shows that so far, themore checklist, matrix, map overlay, and system analysis methods have been often used in project evaluation, and among them, the checklists and matrices due to their efficiency and comprehensiveness are known as the most common evaluation methods. In the matrix method, the types of project-related activities are set in one dimension and a list of environmental parameters (physical-biological, economic-social) that may be affected by the project implementation process is set in another dimension. Using this method, the consequences of all project activities in the relevant periods are identified and evaluated. (Dastorani, 2009: 1). Environmental Impact Assessment (EIA) is a way to assess the environmental consequences of a decision to regulate and , implement policies and plans, or initiate development projects. This method has become a widely accepted tool for environmental management. In fact, it has been defined

as a process for identifying potential consequences for the environments and the physical, socio-economic, environmental, and human health issues environments (Wathern, 1988). EIA is a complex multidimensional process, perhaps because of this complexity, the implementation of EIA is not entirely satisfactory. (Moon, 1998). Environmental impact assessment in our countryIran began in 1975, but after 1979 it showed itself in the country (Makhdoom, 2001: 9). However, after the approval of the Supreme Environmental Council in 1994, the assessment of biological effects gained a position in the executive apparatus and, most importantly, in samong scientific bodies and consulting engineers (Rahmati, 2011: 15).

3. Research Method

The concept of the rapid matrix was developed by Pastakia in 1998. This method is based on a standard definition of important evaluation criteria. Rapid impact assessment matrix is a tool for organizing, analyzing, and showing the results of a comprehensive environmental impact assessment (Sharafi et al., 2008: 46). This method provides special assessment components to define the steps of identifying potential environmental impacts (Salmanzadeh, 2011, 3). One of the advantages of the Rapid Impact Assessment Matrix (RIAM) is the short time required to perform this method. Also, presenting the results graphically makes it easier to compare the options in this way, which is another strength of the Matrix (RIAM) method. In this procedure, after identifying the activities of the suggested plan, their impacts on each one of the environmental parameters of physical – chemical, biological – ecological, social – cultural and economic – technical environments will be recognized. For every part of environment, a score is chosen, using defined standards. After evaluating based on the said standards and mathematical calculations, the domain of effects will be determined from highly positive to highly negative. Ultimately, the analysis of the impacts will happenthe impacts shall be analyzed, using tables and charts associated with sections components of the environment and anticipated resultseffects. In this method, first, the activities of each project must be identified and then their effects on each component of the environment must be determined. For each component of the environment, a score is assigned using the defined criteria. Important criteria in evaluation have two categories:

A) Criteria that are important in terms of importance significance and can have a point or score.

B) Criteria that reveal the value of the situation or condition but do not independently overshadow the scoring. The values set for each set of criteria are determined using specific relationships or formulas.

The relation towith the usable formula introduces the scores for the defined independent components. The process used in the rapid impact assessment method is summarized in the following relation:

(1) (A1) (A2) = AT
(B1) + (B2) + (B 3) = BT
(AT) (BT) = ES

In the above relation, each of the criteria is selected as follows.

A1: Significance of effect A2: Scope of effect
B1: Duration of effect B2: Compatibility of effect
B3: CumulatCumulativeive of effect
ES: Total scores

In the table of the scoring system, separately for each of the criteria, the score is presented, and the characteristics of each score are also expressed and the values of each score are evaluated using the above relation, in a table. Using the matrix, the environmental components are also determined in four categories with the following symbols:

PC: Physicochemical
BE: Biological - Ecological
SC: Socio-Cultural
EO: Economic - Technical

4. Analysis

In this section, the effects of the environment in the construction and operation stages in four physical-chemical, biological-ecological, social-cultural, economic-technical environments in the studied area (Khurshid Park) are evaluated.

The Effect of Khurshid Park Mountain Project Activities on Environmental Factors in the Construction Phase

Table (3-12).

Figure 1. Location of the area under study area (Khurshid Park) .(Source: Authors, 2020:, 3)

Table 1. Standards Used in the Rapid Assessment Method of Environmental Impacts (Source: Authors, 2020: 7)

Criteria	Score	Description
A1 Significance of effect	4	With national or international significance
	3	With regional or national significance
	2	Significant for areas adjacent to areas outside local conditions
	1	Only important for local conditions
	0	Without importance
A2 Scope of effect	+3	With many useful and positive effects and changes
	+2	By making a marked improvement in the place
	+1	By improving the place
	0	Without a change in the place
	-1	With the negative effect in the place
	-2	With many changes and damage
B1 Duration of effect	1	Without changes
	2	Temporary effect
	3	Permanent effect
B2 Reversibility	1	Without changes
	2	Reversible
	3	Irreversible
B3 Cumulative effect	1	Without changes - impossible
	2	Without cumulative effect
	3	With cumulative effect

Table 2. The Cconversion of eEnvironmental sScores into Ddomain iIndicators. (Source: Authors, 2020,: 7)

Scores	Domain	Description
+72 to +108	+E	Useful and positive effects and changes
+36 To +71	+D	Positive and clear effects and changes
+35 to +19	+C	Medium effects and changes
+10 to +18	+B	Positive effects and changes
+1 to +9	+A	Minor positive effects and changes
0	N	No effect and change in location or impossible
-1 to -9	-A	Minor negative effects and changes
-10 to -18	-B	Negative effects and changes
-19 to -35	-C	Medium negative effects and changes
-36 to -71	-D	Specific negative effects and changes
-72 to -108	-E	Many negative effects and changes

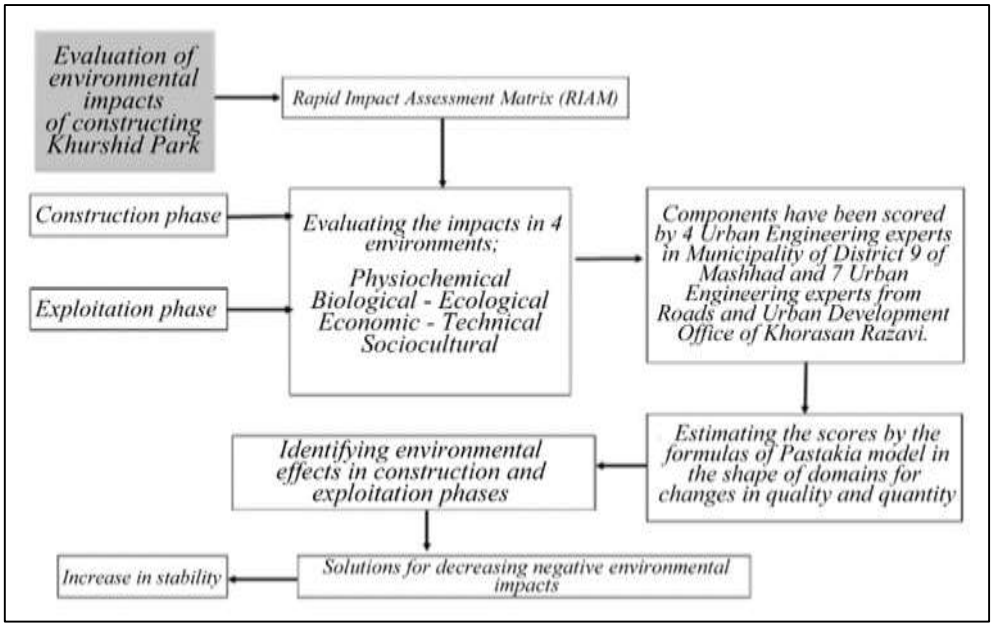


Figure 2. *Conceptual Model of the Study*

Table 3. The Effect of Khurshid Park Mountain Project Activities on Socio-cultural Environmental Factors in the Construction Phase (Source: Authors, 2020: 8)

Assessment criterion							**The effects of activities on environmental factors**	
R	**ES**	**B3**	**B2**	**B1**	**A2**	**A1**		
-B	**-16**	3	2	3	-2	1	Harassment and noise for local communities	SC1
+E	**72**	3	2	3	3	3	Employment	SC2
+E	**108**	3	3	3	3	4	The effect of employment on public participation	SC3
-C	**-32**	3	2	3	-2	2	The effect of employment on population density	SC4
-C	**-32**	3	2	3	-2	2	Creating local traffic	SC5
+D	**56**	3	2	2	2	4	Visual effects	SC6
+D	**42**	2	2	3	3	2	Security	SC7

Table 4. The Effect of Khurshid Mountain Park Project Activities on Physical-chemical Environment Factors in the Construction Phase (Source: Authors, 2020, 9)

The effect of Khurshid park construction project activities on physical-chemical environment factors in the construction phase								
Assessment criteria							**The effect of activities on environmental factors**	
R	**ES**	**B3**	**B2**	**B1**	**A2**	**A1**		
-B	**-14**	3	2	2	-1	2	making noise	PC1
-D	**-54**	3	3	3	-2	3	Soil erosion	PC2
-D	**-48**	3	2	3	-2	3	Air pollution	PC3
-D	**-36**	3	3	3	-2	2	The effect of drilling on the shape of the ground	PC4
-D	**-54**	3	3	3	-2	3	The effect of excavation on surface water quality	PC5
-D	**-54**	3	3	3	-2	3	Waste pollution	PC6
-B	**-18**	3	3	3	-2	1	Construction of facilities	PC7
-A	**-9**	3	3	3	-1	1	Infrastructure and foundation operations	PC8
-B	**-18**	3	3	3	-1	2	Concrete operations and heavy structures	PC9
-C	**-27**	3	3	3	-1	3	Supply, transmission, and consumption of fuel and energy	PC10
-B	**-18**	3	3	3	-1	2	Construction of technical facilities and buildings	PC11

Table 5. The Effect of Khurshid Park Mountain Project Activities on Biological-ecological Environmental Factors in the Construction Phase (Source: Authors, 2020: 9)

Assessment criteria							**The effect of activities on environmental factors**	
R	**ES**	**B3**	**B2**	**B1**	**A2**	**A1**		
-D	**-48**	2	3	3	-2	3	Mountain destruction	BE1
-D	**-42**	3	2	2	-2	3	Loss of green space	BE2
-D	**-48**	2	3	3	-2	3	Impact on land ecosystem	BE3
-D	**-48**	2	3	3	-2	3	Impact on the aquatic ecosystem	BE4
-C	**-24**	2	3	3	-1	3	Impact on plant habitat	BE5
-D	**-48**	2	3	3	-2	3	Impact on animal habitat	BE6
+D	**36**	3	3	3	2	2	Drainage and flood control	BE7
-B	**-16**	2	3	3	-1	2	Production of wastewater and waste	BE8

Table 6. The eEffect of Khurshid Mountain Park Mountain Pproject aActivities on Eeconomic-technical eEnvironmental fFactors in the Cconstruction p Phase. (Source: Authors, 2020,: 10)

The effect of Khurshid park construction project activities on economic-technical environmental factors in the construction phase								
Assessment criteria							**The effect of activities on environmental factors**	
R	**ES**	**B3**	**B2**	**B1**	**A2**	**A1**		
+D	**36**	2	2	2	3	2	Impact on regional revenue	EO1
-C	**-24**	2	2	2	-2	2	Usability change costs	EO2
-B	**-12**	2	2	2	-1	2	Road construction costs	EO3
+C	**28**	3	2	2	2	2	The effect of construction operations on tourism in the region	EO4
-A	**-6**	2	2	2	-1	1	Equipping the workshops	EO5
-C	**-24**	2	3	1	-2	2	Extraction of borrow pits and consumption of the pits	EO6
-B	**-16**	2	3	3	-2	1	Traffic of construction machinery and transportation of personnel and materials	EO7

Table 7. The Ssummary of Cconstruction Pphase Ppoints of Khurshid Mountain Park Mountain Pproject. (Source: Authors, 2020,: 10)

-E	**-D**	**-C**	**-B**	**-A**	**N**	**+A**	**+B**	**+C**	**+D**	**+E**	**Environment** / **effects domain**
0	5	1	4	1	0	0	0	0	0	0	Physicochemical
0	5	1	1	0	0	0	0	0	1	0	Biological and ecological
0	0	2	1	0	0	0	0	0	2	2	Sociocultural
0	0	2	2	1	0	0	0	1	1	0	Economic and technical
0	10	6	8	2	0	0	0	1	4	2	Total scores

Chart 1. The Ssummary of the aAnalysis of the cConstruction Pphase of Khurshid Mountain Park Mountain. (Source: Authors, 2020:, 11)

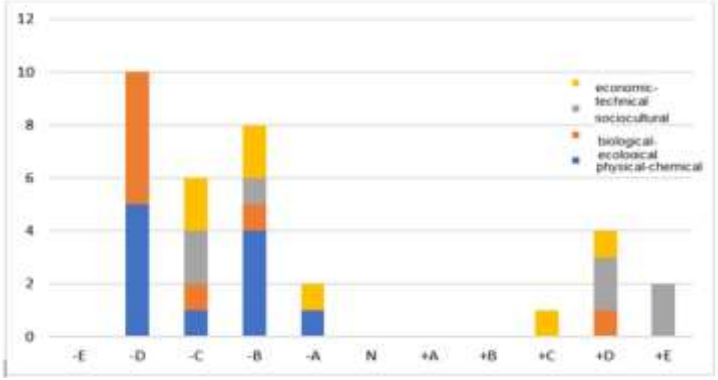


Table 8. The Effect of Khurshid Park Mountain Project Activities on Physical-chemical Environment Factors in the Exploitation Stage (Source: Authors, 2020: 11)

Assessment criteria							**The effect of activities on environmental factors**	
R	**ES**	**B3**	**B2**	**B1**	**A2**	**A1**		
-D	**-48**	3	2	3	-2	3	Climate change	PC1
+D	**48**	3	2	3	3	2	Making noise	PC2
+D	**54**	3	3	3	3	2	Soil erosion	PC3
-C	**-32**	3	2	3	-2	2	Air pollution	PC4
-C	**-28**	3	2	2	-2	2	Loading multiple cultural, tourism, recreational, parking and commercial applications and so on	PC5
+C	**28**	3	2	2	2	2	Optimal visual landscape	PC6
+D	**42**	2	2	3	3	2	Facilities	PC7
-B	**-12**	2	2	2	-1	2	Power supply and transmission	PC8

Table 9. The Effect of Khurshid Park Mountain Project Activities on Biological-ecological Environment Factors in the Exploitation Stage (Source: Authors, 2020: 12)

Assessment criteria							**The effect of activities on environmental factors**	
R	**ES**	**B3**	**B2**	**B1**	**A2**	**A1**		
-D	**-48**	2	3	3	-2	3	The impact of vehicle and human traffic on plants' habitat	BE1
-D	**-42**	3	2	2	-2	3	The impact of vehicle and human traffic on animals' habitat	BE2
-D	**-42**	2	3	2	-2	3	Loss of green space	BE3
-D	**-48**	2	3	3	-2	3	Impact on the land ecosystem	BE4
-D	**-36**	2	2	2	-2	3	Impact on the aquatic ecosystem	BE5
-D	**-48**	2	3	3	-2	3	Impact on the protected areas	BE6
+D	**36**	3	3	3	2	2	Waste disposal effects	BE7

Table 10. The Effect of Khurshid Park Mountain Project Activities on Socio-cultural Environment Factors in the Exploitation Stage (Source: Authors, 2020: 12)

Assessment criteria							**The effect of activities on environmental factors**	
R	**ES**	**B3**	**B2**	**B1**	**A2**	**A1**		
-B	**-16**	3	2	3	-2	1	Impact on the surrounding landscape	SC1
+E	**72**	3	2	3	3	3	Creating local traffic	SC2
+D	**54**	3	3	3	3	2	Impact on increasing services	SC3
-C	**-32**	3	2	3	-2	2	Impact on future development plans	SC4
-C	**-32**	3	2	3	-2	2	Impact on increasing the population of the region	SC5
+C	**28**	3	2	2	2	2	Security	SC6
+D	**42**	2	2	3	3	2	Employment	SC7
+D	**36**	2	2	2	3	2	Real estate prices	SC8
+C	**28**	3	2	2	2	2	Physical health	SC9
-B	**-18**	3	2	1	-3	1	Psychological comfort	SC10

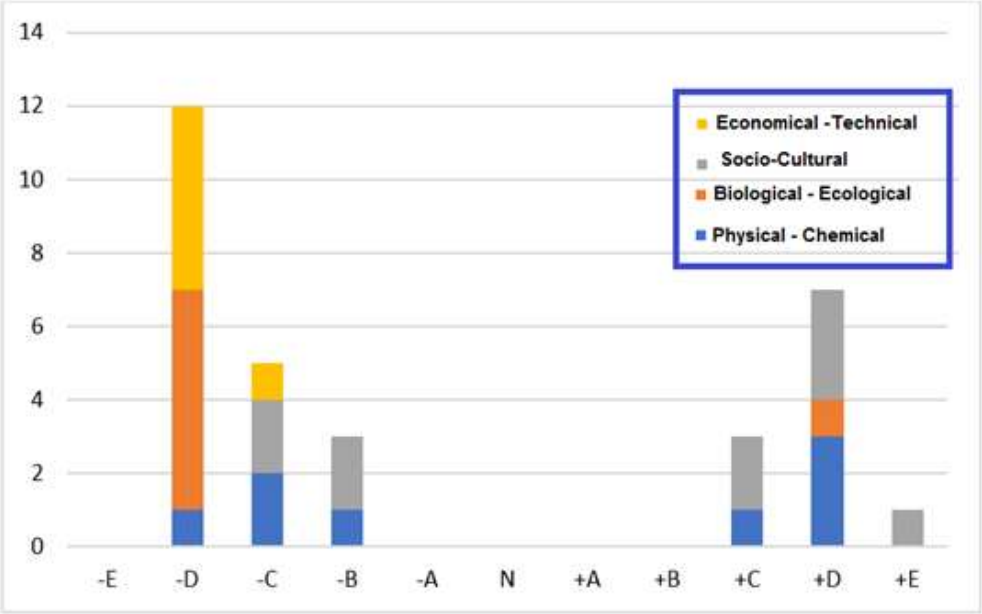
Table 11. The Effect of Khurshid Park Mountain Project Activities on Economic-technical Environment Factors in the Exploitation Stage (Source: Authors, 2020: 13)

Assessment criteria							**The effect of activities on environmental factors**	
R	**ES**	**B3**	**B2**	**B1**	**A2**	**A1**		
-D	**-48**	2	3	3	-2	3	Impact on regional revenue	EO1
-D	**-42**	3	2	2	-2	3	Employment of human forces	EO2
-D	**-48**	2	3	3	-2	3	Rising land and Real Estate prices	EO3
-D	**-48**	2	3	3	-2	3	Expanding tourism	EO4
-C	**-24**	2	3	3	-1	3	Making money through Tele-cabin, amusement parks, parking, etc.	EO5
-D	**-48**	2	3	3	-2	3	Repair and Maintenance	EO6

Table 12. The Summary of Points of the Exploitation Stage of Khurshid Park Mountain Project (Source: Authors, 2020: 13)

-E	**-D**	**-C**	**-B**	**-A**	**N**	**+A**	**+B**	**+C**	**+D**	**+E**	**Environment effects domain**
0	1	2	1	0	0	0	0	1	3	0	Physicochemical
0	6	0	0	0	0	0	0	0	1	0	Biological and ecological
0	0	2	2	0	0	0	0	2	3	1	Sociocultural
0	5	1	0	0	0	0	0	0	0	0	Economic and technical
0	12	5	3	0	0	0	0	3	7	1	Total score

Chart 2. Summary of the Analysis of the Exploitation Phase of Khurshid Mountain Park (Source: Authors, 2020: 14)



5. Conclusion

This study was conducted with the purpose of identifying the important activities of Khurshid Park in the construction and exploitation phases for determining its disadvantageous effects and consequences on the natural environment (southwestern heights of Mashhad). The activities were analyzed through Rapid Impact Assessment Matrix (RIAM) in the format of four environments including physiochemical, biological–ecological, sociocultural and economic– technical environments and in two phases of constructions and exploitation which had been scored by four Urban Engineering experts in Municipality of District 9 of Mashhad and five Urban Engineering experts from Roads and Urban Development Office of Khorasan Razavi. The findings in the construction phase show that constructing Khurshid Park leaves the following impacts:

- In the area of sociocultural environment, the mentioned project has two useful and positive, two positive and clear, two highly negative and one negative effects.
- In the area of physiochemical environment, it has five clear negative, four negative, one minor negative and one medium negative effects.
- In the area of biological-ecological environment, it has five clear negative, one negative, one clear positive and one medium negative effects.
- In the area of economic-technical environment, it has one minor negative, two negative, one clear positive, two medium negative and one medium positive effects.

Also, results regarding the exploitation phase are as follows:

- In the area of physiochemical environment, the project has three clear positive, one medium positive, one negative, two medium negative and one clear negative effects.
- In the area of biological-ecological environment, it has one clear positive and six clear negative effects.

- In the area of sociocultural environment, it has one useful and positive, three clear positive, two positive, two negative and two medium negative effects.
- In the area of economic-technical environment, it has one medium negative and five clear negative effects.

In general, constructing the Khurshid Park project has two useful and positive, four clear positive, one medium positive, two minor negative, eight negative, six medium negative and ten clear negative effects regarding the construction phase and one useful and positive, seven clear positive, three medium positive, three negative, five medium negative and twelve clear negative effects concerning its exploitation phase. To sum up, it can be said that in both phases the negative effects of constructing this project (Khurshid Park) are completely clear. The negative impact of the said project, especially on the biological environment, is

fully obvious. However, the negative results lessen in the exploitation phase. Considering that it is not possible

to entirely eliminate the negative impacts of this project, the intensity and the domain of effects can lessen extremely through suggesting a number of solutions. For minimizing the negative impacts of Khurshid Park Mountain, the following solutions are presented:

- The activities of environmental monitoring throughout construction and exploitation phases of the park;
- In physical environment including monitoring the air, particulates, soil, facilities, and uploading;
- In biological environment including monitoring the wild life, vegetation, leaking substances and natural accidents;
- Social participation: taking the public needs and demands into consideration, increase in informing the local societies, attracting social participations and expanding cooperation;
- Education: holding courses for learning about environment and the advantages of HSE, raising the level of awareness, using persuasion methods regarding personnel in order for them to preserve the environment.

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