ENVIRONMENTAL IMPACT ASSESSMENT OF CONSTRUCTION OF WATER PUMPING STATION IN BACHEH BAZAR PLAIN: A CASE FROM IRAN

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Abstract

Developmental projects in rural areas always require the assessment of multiple environmental impacts. Many projects may have negative effects on the environment which its effects reveal after construction and operation. The study was carried out with the aim of environmental impacts assessment of construction of water pumping station in Bacheh Bazar Plain, Iran. In this study, the Leopold matrix method was used to assess the environmental impacts. Impacts of each project activities on the environmental components were measured using Leopold matrix in two stages of construction and operation. The findings showed that the total environmental impacts of the project were positive (+183 scores). So that the construction and operation of water pumping station will have negative impacts on physical and ecological environments and positive impacts on economic and socio-cultural environments. Finally, it can be concluded that the construction of water pumping station in Bacheh Bazar Plain is justified by observance of the standards. In the end, according to the results of the study, suggestions are made to reduce negative impacts.

Keywords: *environmental impacts assessment, rural development, sustainable agriculture development, providing agricultural water.*

Introduction

Sustainable development along with economic growth and human development, has sought to achieve continuous development through simultaneous consideration of the four economic, social, institutional and environmental sectors (Golusin and Munitlak Ivanovic 2009; Kaivo -Oja et al. 2014; Bachev 2016). Developed

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countries at the beginning of the development path were able to take the initial steps of development, by relying on natural resources and extracting them. Over time, due to neglect of environmental issues and social consequences, and a purely economic viewpoint, problems were created that, gradually, paying attention to these issues, along with the economic aspects of these activities, raised the issue of sustainable development (Moradhaseli et al., 2017). A glance at the environmental situation in recent decades suggests that human activities are the most effective and most important causes of environmental change, which leads to destruction of environment along making good and appropriate changes (Gatti et al., 2012; Ataei et al., 2018a). These activities include agricultural development projects which play a key role in creating environmental problems, such as plant degradation, biodiversity loss, surface and groundwater contamination, severe contamination of the atmosphere, soil erosion and etc. Currently, environmental challenges are one of the most important global and national issues in many countries. Having enough information about countries' environment situation and reviewing the process of environmental change is one of the interest issues for global communities. This issue plays a very important role in recognizing and understanding the status to determine the necessary changes in how management and management programs (Izadi et al., 2017). People regard the protection of the environment with sustainable development and see it as one of their main needs. However, environmental protection is growing rationally, but it is still not seriously considered by governments (Narimisa and Ahmad Basri, 2011; Nemethy & Molnar, 2014). Most countries, including Iran, have invested heavily in the water sector in order to mitigate water scarcity and prevent crises. But unfortunately, studies and assessment of physical structures in the rivers and national and international levels confirm the existence of problems in various dimensions, especially water resources management in dams and modern networks of water distribution (Yaghoubi Farani et al., 2016; Izadi et al., 2017).

Creating any industrial environment affects the environment; thus, environmental impact assessment can play an important role in identifying the potential impacts of development on the environment and reducing environmental problems and contributing to sustainable development (Kaya and Kahraman, 2011). Environmental impacts 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 projects, plans and designs (Sánchez and Saunders, 2011; Grubert, 2018). Also, it identifies the positive and negative potential impacts of a project on the environment as a planning tool (Chang et al., 2018) and help them to reject or accept a project by creating a context for decision makers (Simpson & Basta, 2018). In evaluating the effects, there is usually a great deal of attention in large projects that require attention to the rules and the recognition of the cause of the effects is very important. However, smaller activities, which are often neglected, may also be local or broader scale, because their number is very high and will not be evaluated in most cases (Ljäs et al., 2010). In fact, environmental impact assessment means to provide a method for

determining, predicting and interpreting the environmental impacts of a project on the whole environment, public health and the health of ecosystems that human life depends on (Ilkhani et al., 2017; Elvan, 2018; Enríquez-de-Salamanca, 2018). Also, environmental impact assessment is an effective tool for identifying and predicting the consequences of a project or different projects on the environmental components (physical, biological, social, economic, and cultural) (El-Naqa, 2005).
The concept of the cause in environmental impact assessment means that human activities affect the environment and the environment changes. Also, when society responds to these changes through policy, economic, and environmental laws, activities associated with these policies also exert pressure and complete the feedback cycle. Hence, this approach has three criteria: pressure criteria that comprise environmental pressures from human activities; condition criteria that assess the environmental conditions; and response criteria that assess social responses (Veisi et al., 2012). Accordingly, this research was conducted with the aim of environmental impacts assessment (physical, ecological, economic and socio-cultural dimensions) of the construction of water pumping station in Bacheh Bazar Plain, Iran.

Literature review

In many studies, environmental impact assessment has been carried out in a variety of ways. In some studies, researchers have used Leopold matrix to assess environmental impacts such as the construction of industrial estates (Mosaferi et al., 2015), dam construction (Piri, 2012), construction of recreational places (Alishiri et al., 2015), construction of irrigation and drainage networks (Ataei et al., 2017; Izadi et al., 2017), and Construction of a composting plant (Mirzaee et al., 2010). Also, RIAM matrix used for environmental models and sweeping the sea (Padash, 2016), ranking of scenarios for improving the water cycle (Shakib-Manesh et al., 2014), impact assessment of flood mitigation actions (Gibuena et al., 2013), waste disposal options, gas extraction and waste disposal (Phillips, 2012), assessment of urban waste disposal options (Mondal et al., 2010), environmental effects of steel factories construction (Madani et al., 2016), and environmental impact assessment of tourism projects (Ghorbania et al., 2016).
Also, many studies have been conducted on the assessment of dam construction, including Robinson and Yaghoubi Farani et al. (2016); Guineau (2014); Ansar et al. (2013). According to the World Commission on Dams, the existence of social and environmental problems in dams development projects, Richter et al. (2010) investigated the consequences of dam construction on the people lives of at downstream of the dams in Brazil. They concluded that three key steps in the development of the dam could significantly reduce the destructive effects of dams' downstream. Taheri-Saffar et al. (2015) assessed the economic, social and environmental impacts of dam construction in Neyshabur, Iran and they concluded that the implementation of the project by carrying out corrective actions in the

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design and operation of the reservoir barrier and its related structures as the preferred and final option.

Cellura et al. (2012) have found environmental effects in the production of greenhouse products that the packaging and structure of greenhouses are the main reasons for the emission of environmental pollutants. Josie et al. (2012) were done environmental impact assessment of Chabahar Cement Factory. They indicated that the greatest negative impacts of the project occurred on the biological environment. The most negative impacts on air quality are imposed, among the impacts on the physical environment. The most positive impacts and the benefits of the plan have been related to the social and economic environment. Karbasi et al. (2013) studied the environmental impacts of Abyek Cement Plant. They stated that the plant needs to develop and implement a comprehensive environmental management plan at the plant level in order to improve the environmental situation. Study results Kiani et al. (2015) under the title "Assessment of socio-economic and environmental impacts of Hegmatan Cement Plant" showed that most of the impacts on the environment of the region include degradation of agricultural land, pollution of soil resources, declining agricultural productivity and noise pollution.

Research area

The Bacheh Bazar Plain is located in rural of Kupen, Sorna district, Fars Province, Iran (Figure 1). The research area is located at position 3356795, 528605, 39 region of UTM system in the northwest of Fars province, Iran, about 42 km from city of Noorabad Mamasani and at an altitude of 47379 meters above sea level. The study area is located at 51° 17′ 16.16″ east longitude and 30° 20′ 0.39″ wide latitude.

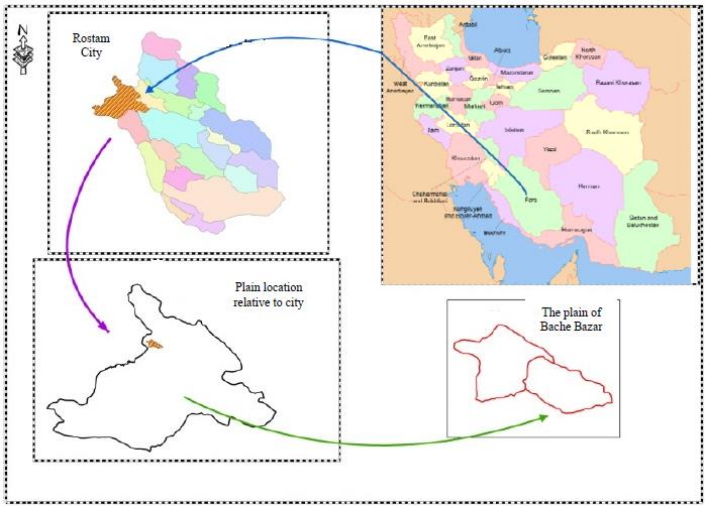

Figure 1
Geographic location of Bacheh Bazar Plain

According to the Population and Housing Census in 2016, the population of Kupen was 3,237. Also, 44.3% of the people worked in the agricultural sector, 22.4% in the industrial sector and 33.3% in the service sector. The most important crops in

the region were wheat, barley, lentils, watermelon and tomatoes. Parallel to the coupons, the Shiva River crosses the water pumping station on the edge of the river. The study area of the Bacheh Bazar Plain has an area of 30.01 km^2. The average slope of the area is 16.69 and the main waterway length is 12.15 km. The annual rainfall mean and annual evaporation from free surface were 726.7 mm and 1496 mm, respectively. There are 21 wells in this plain, of which 19 are active wells and two wells are inactive. Recent droughts have been the main cause of the deactivation of these wells. Most of the wells are semi-deep. The mean of deep and semi-deep wells is estimated to be 79.2 m and 47.25 m, respectively.

Materials and methods

Choosing the appropriate method for environmental impact assessment of a project is the first step in predicting and environmental impacts assessment. The choice of assessment method is influenced by various factors such as project complexity, scale, project cost, and time. The present study was conducted using field surveys and data collection from various sources. Also, environmental impact assessment was carried out using the Leopold matrix.

Commonly used matrix methods include simple matrix, stepwise matrix, Moore matrix, Saratoga matrix, Leopold matrix, weight matrix, Patterson matrix, and rapid environmental impact assessment matrix (Mirzaei et al., 2012). Leopold Matrix is presented at the first time by Leopold et al. (1971). The main advantage of the Leopold Matrix is providing a checklist of the factors required to conduct environmental impact assessment. This matrix was later modified by Dr. Majid Makhdom and is known as the Iranian Leopold matrix (Aghnoum et al., 2014). The simple structure and feasibility of multi-criteria assessment is one of the main advantages of this matrix (Valivadeh and Shekari, 2015).

In this research, we first studied the area of implementation of the project during the visits through observation and interviewing. At a meeting with the president of the village council and local informants, their comments about the construction of the water pumping station were collected. Then, the research team were included a hydraulic structures expert, a geologist, a water resource expert, an environmental expert, a socioeconomic expert and a project manager. Information about the details of the plan and its implementation conditions received from the research team. Finally, analysis was carried out according to all the cases.

In Leopold matrix, the effect of each project activity on the environmental components in the study area during both construction and operation phases, were measured based on physical, ecologic, economic, and socio-cultural environments, and the scores between zero and +5, and zero and -5 were given for the magnitude of impact range. In the columns of the matrix, parameters of the environment are given, and in the rows there are details of the project's activities. As for the advantages of the matrix, we can refer to the expression of the features of each effect on the environment, in that marks numbers used in the matrix represent the status and properties of the effect (Mousavi et al., 2012). At the confluence of

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activity components and environment parameters, if there is an effect in force, the type of effect quality is expressed by using the following descriptions:
A. Type of effect: + and – marks stand for desirable and undesirable effects.
B. Degree of effect: severity of effects represent level of changes with respect to the status quo, i.e. in this research the changes were considered as very high, high, average, low, and very low, which are shown with the numerical symbols 1, 2, 3, 4, and 5.
C. Continuity of effect: effects that occur at a certain point and cannot persist for long are transient effects and represented by a T symbol. Effects that exist in a long term, either periodically or permanently are permanent effect, and they are represented by a P symbol.
D. Time of occurrence: in the Leopold matrix, the three symbols I, M, and L stand for immediate, medium-term, and long-term occurrence respectively.
The main philosophy of environmental impact assessment is the choice between different scenarios. Therefore, in all methods of evaluations, different scenarios must be compared in different parts of the project. In this assessment, the scenarios included two options: non-implementation and the construction of a water pumping station.

Results

The Leopold matrix was applied to analyze the environment components. To this end, the algebraic sum of current values was first calculated for each column. Thus, it was found that every activity is what effect environmental parameters. Total impacts for each of the four environments are obtained from the algebraic sum of the values of all the columns in the two stages of construction and operation. The findings showed that during the construction stage of the water pumping station in the Bacheh Bazar Plain, excavation and embankment, providing saving resources and the construction of access roads would have the most negative impact on the physical environment, respectively. The structures construction will also have the greatest positive impact on the physical environment of the region. In ecological environment, excavation and embankment, providing saving resources, and concreting will had the most negative impacts and green spaces creation will remain the most positive impacts, respectively (Table 1). From the view point of economic environment, the construction of access roads, supplying and transmitting electricity, and worker employment, have the most positive impacts and solid sewage has the most negative impact, respectively. The construction of water pumping station, most actions have a positive impact on the socio-cultural environment. So that the creation of green spaces, supplying and transmitting electricity and the construction of access roads have the most positive impact, respectively. Also, solid waste production has the most negative effect on the socio-cultural environment (Table 2). Ataei et al. (2018b), in the environmental impacts assessment of artificial feeding basins, also found that excavation and embankment, and providing saving resources had a negative impact on the physical environment. Yaghoubi Farani et al. (2016), in the socio-ecological impacts

assessment of dam construction, revealed that the creation of green spaces and supplying and transmitting electricity had the most positive impact on the social environment. Also, other studies (Mirzaee et al., 2010; Alishiri et al., 2015) also confirm these findings.

Table 1. *Prediction matrix of physical (A) and ecological (B) impacts of water pumping station in construction phase*

	Actions											
Environmental parameters	**Worker employment**	**Staff transportation**	**Construction of access roads**	**Construction and tooling workhouse**	**Excavation and embankment**	**Solid sewage**	**Concreting**	**Providing saving resources**	**Materials transportation**	**Supplying and transmitting electricity**	**Green spaces creation**	**Structures construction**
(A) Physical impacts												
Air quality		**-3TM**	**-3TM**		**-4TI**			**-3TI**	**-4TM**		**+5PM**	
Environment sound	**-2TI**	**-5TI**	**-4TI**	**-4TI**	**-5TI**		**-4TI**	**-3TI**	**-3TI**			**-4TI**
Dehydration regime												**+5PL**
Flood regime												
Surface water quality												
Groundwater quality												
Soil salinity												**+1PL**
Surface water consumption											**-2PI**	**+3PM**
Ground water consumption												**+3PM**
Land form			**-2PM**	**-1PI**	**-5PI**		**-2PI**	**-4PI**		**-1PI**		**-2PI**
Soil erosion			**-3PM**		**-5PM**			**-4PM**	**-1PL**		**+5PL**	
Water table												**+4PL**
Total	**-2**	**-8**	**-12**	**-5**	**-19**	**0**	**-6**	**-14**	**-8**	**-1**	**+8**	**+10**
(B) Ecological impacts												
Aquatic ecosystem					**-4TM**	**-1PM**	**-3TI**					**-1PM**
Terrestrial ecosystems			**-3PM**	**-3PI**	**-5PI**	**-5PM**	**-5PI**	**-3PM**		**-1PM**	**+5PM**	**-1PI**
Animal emigration	**-1TM**		**-4PI**		**-5TM**	**-5PI**	**-4PI**	**-5PM**			**+4PL**	**-3PM**
Animal habitat		**-1TI**	**-3PI**	**-3TI**	**-5PI**	**-1TI**	**-4PI**	**-4PI**			**+4PM**	**-4PI**
Plants habitat	**-2TM**		**-5PM**		**-5PI**	**-1TL**	**-4PM**	**-4PL**			**+5PL**	**-3PL**
Herbal scarce species	**-2TM**		**-4PL**	**-2TL**	**-5PM**	**-2TL**	**-4PM**	**-5PM**			**+5PL**	**-2PL**
Animal scarce species			**-3PM**	**-2TM**	**-5PI**	**-1TL**	**-4PI**	**-5PI**			**+5PL**	**-1PL**
Animal population			**-1PL**	**-1TL**	**-4PM**		**-4PM**	**-5TM**			**+5PM**	**-2PL**
Disease vectors					**-3TM**	**-3TL**		**-2PL**			**+4PL**	
Total	**-5**	**-1**	**-23**	**-11**	**-41**	**-19**	**-32**	**-33**	**0**	**-1**	**+32**	**-18**

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Table 2. *Prediction matrix of economic (A) and socio-cultural (B) impacts of water pumping station in construction phase*

	Actions											
Environmental parameters	**Worker employment**	**Staff transportation**	**Construction of access roads**	**Construction and tooling workhouse**	**Excavation and embankment**	**Solid sewage**	**Concreting**	**Providing saving resources**	**Materials transportation**	**Supplying and transmitting electricity**	**Green spaces creation**	**Structures construction**
(A) Economic impacts												
Income and expense	**+3TI**		**+3PI**						**+1TI**	**+1PM**		
Employment and unemployment	**+5TI**	**+3TI**	**+4PL**		**+1TI**		**+1TI**			**+2PL**		
Real estate price			**+4PL**							**+2PL**	**+1PL**	
Agriculture	**-2TI**		**+2PL**		**-1TI**	**-3PM**				**+4PM**		
Industry and mine			**+3PM**							**+3PL**		
Services	**+1TI**		**+3PM**							**+1PM**		
Transportation		**+2TI**	**+5PI**			**-1TM**			**-1TI**	**+1PM**		
Welfare			**+1PL**							**+4PL**	**+1PL**	
Land use			**-2PL**	**-1TI**	**-1PI**	**-1PI**						
Future development projects			**+4PL**			**-3PL**				**+4PL**		
Total	**+7**	**+5**	**+27**	**-1**	**-1**	**-8**	**+1**	**0**	**0**	**+23**	**+2**	**0**
(B) Socio-cultural impacts												
Population		**+1TI**	**+2PL**							**+4PL**	**+1PL**	
Migration	**+4TI**		**+3PM**			**-1TM**				**+3PL**	**+3PM**	
Participation of users	**+4TM**		**+1TM**							**+1PM**		
Leisure times			**+1PM**			**-1TI**				**+2PM**	**+5PM**	
Social acceptance			**+1TL**			**-1TI**				**+2TL**		**+4PL**
Hygienic indicators						**-5PL**						
Educational indicators			**+1PM**							**+1PM**		
Water drinking and water supply quality						**-2PM**						**+1PL**
Tourism			**+4PL**			**-5PM**				**+2PL**	**+4PL**	
Religious and historical building												
Landscape and sights					**-4PM**	**-3PM**					**+5PL**	
Total	**+8**	**+1**	**+13**	**0**	**-4**	**-18**	**0**	**0**	**0**	**+15**	**+18**	**+5**

At the operation phase of the water pumping station, two activities of torrent control and distribution and use of water had the most positive impact and two activities of use of fertilizers and chemical pesticides had the most negative impact on the physical environment, respectively. However, two activities of torrent control and maintenance of green spaces have the most positive impact on the ecological environment, respectively. Also, development of recreational activities,

the use of fertilizers and chemical pesticides have negative impacts on this environment (Table 3).

Table 3. Prediction matrix of physical (A) and ecological (B) impacts of water pumping station in operation phase

	Actions								
Environmental parameters	**Water supply**	**Torrent control**	**Recreational activities development**	**Poisons consumption**	**Fertilizers consumption**	**Distribution and use of water**	**Maintenance of green spaces**	**Maintenance of access routes**	**Repair and maintenance of structures**
(A) Physical impacts									
Air quality	**+1PL**						**+5PL**	**-2PL**	
Environment sound								**-1PM**	
Dehydration regime	**+5PL**	**+2PM**				**+2TL**			**+3PL**
Flood regime	**+3PL**	**+5PL**				**+4TL**			**+4PM**
Surface water quality		**+5PM**		**-2PL**	**-2PL**				**+4PM**
Groundwater quality	**+3PL**	**+5PM**		**-4PL**	**-4PL**	**+1PL**			**+1PL**
Soil salinity	**+3PL**	**-2PM**		**-4PL**	**-4PL**	**+3PL**	**+1PL**		**+4PL**
Surface water consumption	**-5PM**		**-2PL**	**-3PM**	**-3PM**	**-4PM**	**-2PI**		
Groundwater consumption	**+4PL**			**-4PL**	**-4PL**	**+5PL**	**+1PL**		
Land form	**+2TL**	**+2PM**				**+4PM**			**+2PL**
Soil erosion		**+5PL**					**+4PL**	**-3PL**	
Water table	**+2TL**					**+3PL**			
Total	**+18**	**+22**	**-2**	**-17**	**-17**	**+19**	**+9**	**-6**	**+18**
(B) Ecological impacts									
Aquatic ecosystem		**+4PL**		**-3PL**	**-3PL**				
Terrestrial ecosystems	**+3PL**	**+5PM**	**-2TI**				**+4PI**	**-3PM**	
Animal emigration		**+3PM**	**-1TL**				**+4PL**		
Animal habitat	**+2PM**	**+4PI**	**-2PM**				**+4PM**	**-1PM**	
Plants habitat	**+4PM**	**+5PM**	**-1PI**				**+4PM**	**-1PL**	
Herbal scarce species	**+2PL**	**+3PM**	**-1PL**				**+1PL**	**-1PL**	**+1PL**
Animal scarce species	**+1PL**	**+1PL**	**-1TL**				**+3PL**		
Animal population	**+2PM**	**+2PL**					**+4PM**		
Disease vectors		**+3PI**		**-5PL**	**-5PL**		**+3PM**		
Total	**+14**	**+30**	**-8**	**-8**	**-8**	**0**	**+27**	**-6**	**+1**

In the operation stage of the water pumping station, all activities have positive impacts on the economic environment, other than the two activities of the use of fertilizers and chemical pesticides. So, activities of water supply, torrent control and maintenance of the access routes will have the most positive impact, respectively. Also, at this phase, activities of torrent control, water supply, and recreational activities development will have the most positive impact on the socio-cultural environment of the project, respectively (Table 4).

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Table 4. *Prediction matrix of economic (A) and socio-cultural (B) impacts of water pumping station in construction phase.*

	Actions								
Environmental parameters	**Water supply**	**Torrent control**	**Recreational activities development**	**Poisons consumption**	**Fertilizers consumption**	**Distribution and use of water**	**Maintenance of green spaces**	**Maintenance of access routes**	**Repair and maintenance of structures**
(A) Economic impacts									
Income and expense	**+3PL**							**+1PM**	**+1PL**
Employment and unemployment	**+4PM**		**+1PL**					**+2PL**	
Real estate price	**+3PL**		**+3PM**			**+4PM**			
Agriculture	**+5PI**	**+5PI**		**-2PL**	**-2PL**	**+4PM**		**+3PI**	**+5PM**
Industry and mine	**+4PL**	**+1PI**						**+2PM**	
Services	**+1PM**	**+4PM**				**+2PL**		**+1PL**	
Transportation		**+5PI**						**+2PI**	
Welfare	**+3PM**		**+3PL**			**+2PL**	**+1PL**		
Land use	**+3PM**	**+3PM**				**+3PL**		**+3PM**	**+1PL**
Future development projects	**+4PL**	**+5PL**						**+3PL**	**+1PL**
Total	**+30**	**+23**	**+7**	**-2**	**-2**	**+15**	**+1**	**+17**	**+8**
(B) Socio-cultural impacts									
Population	**+2PL**	**+2PL**	**+4PL**			**+5PL**	**+5PL**		**+1PL**
Migration	**+5PM**	**+2PM**	**+4PM**			**+4PM**	**+2PL**		**+1PL**
Participation of users	**+5PM**	**+2PM**	**+3PL**			**+4PL**	**+2PM**		**+3PL**
Leisure times			**+5PI**				**+4PI**		
Social acceptance	**+5PM**	**+4PM**	**+1PM**			**+4PL**	**+1PM**		**+5PL**
Hygienic indicators		**+5PI**		**-3PL**	**-3PL**				
Educational indicators									
Water drinking and water supply quality	**+4PM**	**+5PI**		**-4PL**	**-4PL**	**+2PL**			
Tourism	**+1PL**	**+3PL**	**+5PL**			**+1PL**	**+4PL**	**+1PL**	
Religious and historical building	**+1PM**	**+3PI**				**+1PL**			
Landscape and sights	**+5PL**	**+3PM**	**+3PI**				**+5PM**		
Total	**+28**	**+29**	**+25**	**-7**	**-7**	**+21**	**+23**	**+1**	**+10**

Ataei et al. (2017), in the environmental components assessment of irrigation and drainage networks, stated that the two activities of the use of fertilizers and chemical pesticides had most negative impact on the physical environment and torrent control and the development of recreational activities had the most positive impact on the socio-cultural environment. Izadi et al. (2017) also revealed that the negative impacts of developmental projects in rural areas would be more on the physical and ecological environments and positive impacts on the socio-cultural and economic environments. Also, Ataei & Karimghasemi (2017) concluded that torrent control and maintenance of access routes have the most positive impact on the economic environment of the region in the environmental impacts assessment of artificial feeding basins.

The compilation of positive and negative effects in the physical environment showed that negative transient impacts were more than positive transient impacts. But positive permanent impacts were more than negative permanent impacts. In general, the permanent positive and negative impacts were more than the positive and negative transient impacts. However, by comparing the total positive and negative impacts in the physical environment, it was determined that by constructing and operating the water pumping station, the negative impacts imposed on the physical environment are more than positive impacts (Table 5).

Table 5. *Summary of physical impacts of water pumping station in Hamami plain.*

Impacts	Environmental parameters												
	Air quality	Environment sound	Dehydration regime	Flood regime	Surface water quality	Groundwater quality	Soil salinity	Surface water consumption	Groundwater consumption	Land form	Soil erosion	Water table	Total
Number of positive impacts of P	3	0	4	3	2	4	5	1	4	3	3	2	34
Number of negative impacts of P	1	1	0	0	2	2	3	7	2	7	5	0	30
Total of positive values of P	11	0	15	12	9	10	12	3	13	8	14	7	114
Total of negative values of P	2	1	0	0	4	8	10	21	8	17	16	0	87
Number of positive impacts of T	0	0	1	1	0	0	0	0	0	1	0	1	4
Number of negative impacts of T	5	9	0	0	0	0	0	0	0	0	0	0	14
Total of positive values of T	0	0	2	4	0	0	0	0	0	2	0	2	10
Total of negative values of T	17	34	0	0	0	0	0	0	0	0	0	0	51
Total number of positive impacts	3	0	5	4	2	4	5	1	4	4	3	3	38
Total number of negative impacts	6	10	0	0	2	2	3	7	2	7	5	0	44
Total of positive values	11	0	17	16	9	10	12	3	13	10	14	9	124
Total of negative values	19	35	0	0	4	8	10	21	8	17	16	0	138

The gained findings from the compilation of the impacts in the ecological environment showed that the permanent negative impacts were more than positive permanent impacts. Also, positive transient impacts were less than negative transient impacts. In general, by comparing the total positive and negative impacts in the ecological environment, it was revealed that the negative impacts of construction and operation of water pumping station in Bacheh Bazar Plain would

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be more positive impacts (Table 6). This finding is also consistent with the results of Karbasi et al. (2013); Kiani et al. (2015).

Table 6. *Summary of ecological impacts of water pumping station in Bache Bazar Plain.*

Impacts	Environmental parameters									
	Aquatic ecosystem	Terrestrial ecosystems	Animal emigration	Animal habitat	Plants habitat	Herbal scarce species	Animal scarce species	Animal population	Disease vectors	Total
Number of positive impacts of P	1	4	3	4	4	5	4	4	3	32
Number of negative impacts of P	4	9	5	7	7	7	5	4	3	51
Total of positive values of P	4	17	11	14	18	12	10	13	10	109
Total of negative values of P	8	29	26	23	23	22	18	16	12	177
Number of positive impacts of T	0	0	0	0	0	0	0	0	0	0
Number of negative impacts of T	2	1	3	3	2	3	3	2	2	21
Total of positive values of T	0	0	0	0	0	0	0	0	0	0
Total of negative values of T	7	2	7	5	3	6	4	6	6	46
Total number of positive impacts	1	4	3	4	4	5	4	4	3	32
Total number of negative impacts	6	10	8	10	9	10	8	6	5	72
Total of positive values	4	17	11	14	18	12	10	13	10	109
Total of negative values	15	31	33	28	26	28	22	22	18	223

The compilation of impacts in the economic environment revealed that permanent positive impacts had more permanent negative impacts. Also, positive transient impacts were more than negative transient impacts. In general, comparing the total positive and negative impacts in the economic environment revealed that the negative impacts of the construction and operation of the water pumping station were less than the positive impacts (Table 7). The findings from the compilation of impacts in the socio-cultural environment showed that permanent positive impacts had a greater than negative permanent impacts. Also, positive transient impacts were more than negative transient impacts. In general, by comparing the total positive and negative impacts in the socio-cultural environment, it was revealed that the positive impacts of the construction and operation of the water pumping station in the Bacheh Bazar Plain were more than the negative impacts (Table 8). Research of Yaghoubi Farani et al. (2016); Ataei et al. (2017); Izadi et al. (2017) confirm these findings.

Table 7. *Summary of economic impacts of water pumping station in Bache Bazar Plain.*

Impacts	Environmental parameters										
	Income and expense	Employment and unemployment	Real estate price	Agriculture	Industry and mine	Services	Transportation	Welfare	Land use	Future development projects	Total
Number of positive impacts of P	5	5	6	7	5	6	4	7	5	6	56
Number of negative impacts of P	0	0	0	3	0	0	0	0	3	1	7
Total of positive values of P	9	13	17	28	13	12	13	15	13	21	153
Total of negative values of P	0	0	0	7	0	0	0	0	4	3	14
Number of positive impacts of T	2	4	0	0	0	1	1	0	0	0	8
Number of negative impacts of T	0	0	0	2	0	0	2	0	1	0	5
Total of positive values of T	4	10	0	0	0	1	2	0	0	0	17
Total of negative values of T	0	0	0	3	0	0	2	0	1	0	6
Total number of positive impacts	7	9	6	7	5	7	5	7	5	6	64
Total number of negative impacts	0	0	0	5	0	0	2	0	4	1	12
Total of positive values	13	23	17	28	13	13	15	15	13	21	170
Total of negative values	0	0	0	10	0	0	2	0	5	3	20

Table 8. *Summary of socio-cultural impacts of water pumping station in Bache Bazar Plain*

Impacts	Environmental parameters											
	Population	Migration	Participation of users	Leisure times	Social acceptance	Hygienic indicators	Educational indicators	Water drinking and water supply quality	Tourism	Religious and historical building	Landscape and sights	Total
Number of positive impacts of P	9	9	7	5	7	1	2	4	9	3	5	61
Number of negative impacts of P	0	0	0	0	0	3	0	3	1	0	2	9
Total of positive values of P	26	27	20	17	24	5	2	12	25	5	21	184
Total of negative values of P	0	0	0	0	0	11	0	10	5	0	7	33
Number of positive impacts of T	1	1	2	0	2	0	0	0	0	0	0	6
Number of negative impacts of T	0	1	0	1	1	0	0	0	0	0	0	3
Total of positive values of T	1	4	5	0	3	0	0	0	0	0	0	13
Total of negative values of T	0	1	0	1	1	0	0	0	0	0	0	3
Total number of positive impacts	10	10	9	5	9	1	2	4	9	3	5	67
Total number of negative impacts	0	1	0	1	1	3	0	3	1	0	2	12
Total of positive values	27	31	25	17	27	5	2	12	25	5	21	197
Total of negative values	0	1	0	1	1	11	0	10	5	0	7	36

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Conclusions

Obviously, when it comes to designing a plan, it should be a difficult and long journey to exploit it. Environmental considerations at all stages of the implementation of the plan are one of the main issues that should be considered, which involves all stages of design, implementation, and even after the operation of the project. If the assessment of the interactions of the environment and human functions is carried out in the form of development projects, potential, its environment and its potential, and the impacts on the functions are revealed through initial knowledge. The degree of significance and dimensions of negative impacts also reveals that these works can be managed using modern practices, application of the rules, and ultimately malware reduction programs and environmental management plans. The study was carried out with the aim of environmental impacts assessment of construction of water pumping station in Bacheh Bazar Plain, Iran. The findings indicated that the total value of the construction of the water pumping station on the physical, ecological, economic and socio-cultural environments is 600 scores that with the socio-cultural environment had the highest score (197 scores). Also, the total value of the construction and operation of this project is 417 scores that the highest score is revealed in ecological environment (223 scores). Finally, the algebraic values showed that the construction and operation of the water pumping station would have negative impacts on the physical and ecological environments and the positive impacts on the economic and socio-cultural environments. However, the algebraic aggregation of impacts in all four environments revealed that the impacts on the Bicheh Bazar Plain were positive impacts (+183 scores). Other results are presented in Table 9.

Table 9 *Overall situation of environmental impacts of water pumping station construction.*

Impacts	Environment				
	Physical	Ecological	Economic	Socio-Cultural	All environments
Total number of positive impacts	**38**	**32**	**64**	**67**	**201**
Total number of negative impacts	**44**	**72**	**12**	**12**	**140**
Total of positive values	**124**	**109**	**170**	**197**	**600**
Total of negative values	**138**	**223**	**20**	**36**	**417**
Algebraic sum of values	**-14**	**-114**	**+150**	**+161**	**+183**

Considering the environmental impact assessment results of the project to construct water pumping station in the plain of Bacheh Bazar and comparing the two scenario of not implementing or implementation of the project, it can be concluded that the implementation of the project by making corrective actions is the ultimate scenario. In the event that the impacts are negative, most of the impacts are mild and insignificant which the negative impacts can be reduced, with proper

management and implementation of proposed environmental measures. Also, with population growth and rising food needs, unemployment and migrating villagers to cities, implementation of the plan will have many positive results in terms of employment, income levels, immigration and welfare of villagers. Therefore, it can be said that the implementation of the water pumping station has many favorable impacts that undermine undesirable impacts and create significant and important benefits to the region. Therefore, the implementation of this plan is feasible and it is necessary to minimize the potential negative impacts of project implementation in order to achieve the desired goals and align with the macro policies by applying appropriate environmental management systems in a way. To this end, it is necessary to step in with the environmental management in pursuit of sustainable development goals. Also, it should consider long term negative impacts. For example, structures construction, solid sewage, and excavation and embankment had negative impacts on the components of ecologic environment. These negative impacts can decrease natural environment efficiency in long term. Solid sewage also had long term negative impacts on the components of economic environment. These negative impacts can affect economic productivity of the region activities.

Accordingly, it can propose solutions to reduce the negative impacts on different environments in the two phases of construction and operation. For example, it should avoid unnecessary excavations and embankments. The withdrawal of providing saving resources should not exceed the amount that the experts determine. Health and safety regulations should be introduced and applied such as preventing the discharge of sewage, waste, construction waste to the river, which causes the destruction of aquatic animals. The necessary human resources provided from the surrounding villages for increasing the people participation of the region in the project implementation. It avoided changing land use and monitored development activities. It can recommend mitigating the adverse impacts of the project that farmers are trained to decrease use of chemical fertilizers and pesticides. Also, the activities of operation phase should be planned based on a comprehensive working framework and they are regularly monitored while doing activities.

It recommended for further research that various methods and tools simultaneously used to assess environmental impacts and their results compared together. In other words, efficiency of various methods is investigated to assess environmental impacts. Also, it suggested that environmental impacts of the project are evaluated after ending operation and construction phases. Then, their results are compared with assessment of pre-operation phase.

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ETUDE D'IMPACT SUR L'ENVIRONNEMENT D'UNE STATION DE POMPAGE DE L'EAU DANS LA PLAINE DE BACHEH BAZAR: UN CAS IRANIEN

Resumé
Les projets de développement dans les zones rurales nécessitent toujours l'évaluation de multiples impacts environnementaux. De nombreux projets peuvent avoir des effets négatifs sur l'environnement, effets qui se révèlent après la construction et l'exploitation. L'étude a été réalisée dans le but d'évaluer l'impact sur l'environnement de la construction d'une station de pompage d'eau dans la plaine de Bacheh Bazar, en Iran. Dans cette étude, la méthode matricielle de Léopold a été utilisée pour évaluer les impacts. Les impacts de chaque activité du projet sur les composantes environnementales ont été mesurés à l'aide de la matrice de Léopold en deux étapes de construction et d'exploitation. Les résultats ont montré que les impacts environnementaux totaux du projet étaient positifs (+183 scores). Ainsi, la construction et l'exploitation d'une station de pompage d'eau auront des impacts négatifs sur les environnements physiques et écologiques et des impacts positifs sur les environnements économiques et socioculturels. Enfin, on peut conclure que la construction d'une station de pompage d'eau dans la plaine de Bacheh Bazar est justifiée par le respect des normes. Au final, selon les résultats de l'étude, des suggestions sont faites pour réduire les impacts négatifs.

Mots-clés: *évaluation des incidences sur l'environnement, développement rural, développement de l'agriculture durable, fourniture d'eau en agriculture.*

VALUTAZIONE DELL'IMPATTO AMBIENTALE DELLA STAZIONE DI POMPAGGIO DELL'ACQUA NELLA PIANA DI BACHEH BAZAR: UN CASO DALL'IRAN

Riassunto
I progetti di sviluppo nelle aree rurali richiedono sempre la valutazione di molteplici impatti ambientali. Molti progetti possono avere effetti negativi sull'ambiente che i suoi effetti rivelano dopo la costruzione e il funzionamento. Lo studio è stato condotto con l'obiettivo di valutare l'impatto ambientale della costruzione della stazione di pompaggio dell'acqua nella Bacheh Bazar Plain, in Iran. In questo studio, il metodo della matrice Leopold è stato utilizzato per valutare gli impatti. Gli impatti di ciascuna attività del progetto sui componenti ambientali sono stati misurati utilizzando la matrice Leopold in due fasi di costruzione e funzionamento. I risultati hanno mostrato che gli impatti ambientali totali del progetto erano positivi (183 punteggi). Affinché la costruzione e il funzionamento della stazione di pompaggio dell'acqua abbiano impatti negativi su ambienti fisici ed ecologici e impatti positivi su ambienti economici e socio-culturali. Infine, si può concludere che la costruzione della stazione di pompaggio dell'acqua nella pianura di Bacheh Bazar è giustificata dall'osservanza degli standard. Alla fine, in base ai risultati dello studio, vengono proposti suggerimenti per ridurre gli impatti negativi.

Parole chiave: *valutazione dell'impatto ambientale, sviluppo rurale, sviluppo agricolo sostenibile, fornitura di acqua agricola.*