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ORIGINAL RESEARCH PAPER

Socio-economic, cultural, physical and ecological impact assessment of Kavar irrigation and drainage network in Iran

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ABSTRACT: Environmental impacts assessment may be some measures to offset the impact to an acceptable level or explore new solutions. The research was conducted with the aim of assessing the socio-economic, cultural, physical and ecological impacts of Kavar irrigation and drainage network in Fars Province (Iran). In this study, Environmental impacts assessment was undertaken by ICOLD matrix. The ICOLD matrix is one of the flexible methods that converted qualitative data into quantitative data. In this method, the effect of the project activities on the environmental components were assessed in two stages; project construction and operation based on physical, ecological, socio-economic and cultural aspects. The findings indicated that positive effects will be generally exerted on the region environment by establishing and operating irrigation and drainage network in Kavar plain. In other words, substantial positive impacts will be seen in the region consequently; such as improving the average level of aquifer, enhancement of agricultural wells, and agriculture development in the region. However, in order to alleviate the negative impacts of the projects processes, it is suggested that presented environmental training to farmers, collaborating and further communicating with other relevant organizations and institutions.

KEYWORDS: *Environmental impact assessment (EIA); Irrigation and drainage network; Rural development; Sustainable development*

INTRODUCTION

In past centuries, human made changes in the environment with the slow process, but there is strong evidence that recently human behavior has created critical ecological problems. For example, research showed that people made changes nature faster and more extensive than the same time period in the history, in during recent 50 years (Millennium Ecosystem Assessment, 2005). Global ecological problems such as depletion of natural resources, increased pollution and population are challenges that needed to more ponder. Human was believed that can achieve to development by maximizing economic growth and increasing consumption of available resources. But, the emergence of the crisis of unemployment, poverty and social inequality revealed that attention to social and environmental dimensions of development is inevitable. For example, Green Revolution emerged with the aim of agriculture transition toward self-sufficiency

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and development, but soil erosion, ecological instability, poverty, unemployment and social inequality were important consequences of Green Revolution (Moinoddin, 2006; He *et al.*, 2016; Zeleòáková and Zvijáková, 2017).

In recent decades, environmental impact assessments during process of planning projects, created considerable awareness about the benefits involved in sustainable development and environmental protection worldwide (Gilbuena *et al.*, 2013; Jiang *et al.*, 2017; Aguilar-Støen and Hirsch, 2017; Ataei *et al.*, 2018) and its' identified the type, importance, and severity of the environmental consequences of human activities (Ashofteh *et al.*, 2016; Toniolo *et al.*, 2017). Researchers believe that the main causes of weakness in a conducting and applying environmental impact assessment and their inefficiency are associated with political rules (Zhu *et al.*, 2015; Borioni *et al.*, 2017), encouraging mechanisms, organizational discipline and order, and lack of proper methodology (Ren, 2013; Kim and Tae, 2016).

Inclusion of environmental and social components, suggestions and analysis of different project interventions ensuring local people participation are the key strengths of the environmental impact assessments (Lilley, 2016). EIA is a compulsory evaluation instrument for environmental management and decision making processes and applies to different phases of activities (plans, programs, projects and/or existing production or services), because it can measure the natural and anthropogenic activities effects on the environment. These impacts may affect the cultural, biodiversity, social-economic conditions and human health as well as the ecosystem equilibrium (Robu *et al.*, 2015; Yaghoubi Farani *et al.*, 2016; Ataei and Karimghasemi, 2017). EIA is a main tool to water resources management (Le Clerc and Galet-Lalande, 2011; Karami *et al.*, 2017). The environmental impact assessment of the implementation related to the significant issues of regional ecological security, sustainable economic development and sustainable social development (Liu *et al.*, 2015). The regulation of EIA gives responsibilities to the corporations, installations and enterprises by law to prepare an "EIA Report" for the each activity that can cause environmental problems. Thus, it can be said that effective and efficient EIA process is very important in terms of outstanding issues such as conservation of biodiversity and socio-economic conditions (Ozcan and Strauss, 2014).

Due to recently drought and the increasing importance of water in different aspects of human life, most countries (such as Iran) have done extensive investment programs in order to control and manage water and irrigation practices and change irrigation methods by the construction of engineering structures, especially irrigation and drainage networks. Modern irrigation and drainage network can improve agricultural water efficiency and agriculture development (Ataei and Izadi, 2014a; 2014b). Modern irrigation and drainage networks are building in Fars Province, Iran with a lot of investment that attention to the environmental aspects of the projects before their implementation is necessary. Therefore, given the growing problem of environmental issues and overhead costs to the various activities on the quality of their environment, attention to environmental components and further evaluation should be considered.

Several studies mentioned to the environmental impact assessment of plans and projects. For instance, Mousavi *et al.*, (2011) used LEOPOLD matrix and ICOLD for Environmental Impact Assessment of Kor Dam in Sistan and Baluchestan province (Iran) and concluded that most negative impacts are related to physical environment in the construction phase and the most positive impacts are related to socio-economic environment in the operation phase. Paply Yazdi and Shateri (2003) concluded that deep and semi-deep wells have positive and negative consequences have followed a negative impact mainly on environmental issues. Malek Hosseini and Mirak Zadeh (2014) carried out a research about social impact assessment of Soleimanshah dam in Iran. Their results indicated that Soleimanshah Dam had the positive and negative effects on the villagers. They categorized impacts in 10 categories of increasing life expectancy, improving security in the region, developing tourism, increasing employment, reducing poverty, unity and social cohesion, strengthening social capital, uneven development and fundamental rights violations can be summarized. Jalili kenari and Salehi (2014) stated that using chemicals in farms have negative impacts on the environment (the impact on water resources, agricultural waste) and social aspect (health, employment and tourism).

Ashofteh *et al.* (2016) performed an EIA of the Shahriar Dam in Iran. In their study physical, biological, and socio-economic aspects are assessed in the short and long terms periods by the Leopold matrix method.

Their results showed that implementation of the project has most negative impact in the biological aspect ("48 score) in short-term period, while it will most positive impact the socio-economic aspect in long-term period (+233 score). Ahmadvand *et al*. (2009) assessed the impact of agricultural projects and they stated that although social impact assessment of projects have not any wide status in agricultural development projects, but the negative consequences on people's livelihood caused special attention to the social impact assessment, especially in the environmental dimension. So EIA should be emphasized in all projects. Huang *et al*. (2015) in their study found that the negative environmental impacts in the construction phase are more than the operation phase. Toro *et al*. (2012) also showed that there is a positive correlation between the extent of environmental impacts and environmental profile projects, such as near the project site and technical specifications of the project. Mirsanjari *et al*. (2013) conducted an EIA and their findings showed that tourism has been damaged ecotourism environmental such as erosion and soil compaction, destruction of habitat, flora and fauna, water and air pollution, damage to the agricultural economy and the natural landscape of the area. Also, Ijigah *et al*. (2013) noted that the construction phase of projects have the most significant negative environmental impacts that it including environmental pollution, depletion of resources and degradation of ecosystems.

Analysis of the environmental impact of physical development in rural areas also suggests that changes in agricultural land use reduce the quantity of drinking water, waste disposal problems and lead to the development of sound pollution (Hesam *et al*., 2015). Results of EIA on land use and land cover by Korir (2014) showed that inadequate and inappropriate regulations and policies, inadequate infrastructure capacity, weakness of environmental information, lack of community participation in development planning were implementation impacts of this project. Environmental impacts of Boga Bridge in Bangladesh were included loss of livelihood, loss of land, delta formation, loss of trees and rare species, loss of fisheries, navigational restrictions, surface water pollution, air pollution, soil contamination, river bank erosion, changing the river flow. The environmental impacts score of this project were "–3" (Islam, 2015). Liao *et al*. (2013) in the environmental impacts assessment of livestock and poultry manure concluded that the livestock and poultry breeding industry had little impact on soil environment, but posed a grave threat to water environment. Also, the results obtained in the EIA of biogas upgrading (mainly associated with the cultural and socio-economic components) make the project feasible and all the negative impacts can be mitigated by preventive and remedial measures (Morero *et al*., 2015). As a result, this study aimed to assess the environmental impact of the construction of irrigation and drainage network in Fars province, Iran. This assessment includes four aspects: Socio-economic, cultural, physical and ecological. This study has been carried out in Kavar irrigation and drainage network of Iran in 2016.

MATERIALS AND METHODS

In this research, environmental impact assessment of the irrigation and drainage network in Fars province (Iran) was performed by using ICOLD matrix. ICOLD matrix can transform the qualitative results of environmental assessment in a project to quantitative results. In this method, the effect of each project activity on the environmental components in the study area was measured based on physical, ecologic, socio-economic, and cultural environments, during both construction and operation phases. The extent of effect range estimated between 0 and +5, and 0 and -5. The physical, ecologic, socio-economic, and cultural environments components are listed in the columns of the matrix and sub-activities of the projects are taken down in their lines (Karimi *et al*., 2009). As for the advantages of the matrix, it can refer to the expression of the features of each effect on the environment, in that marks, used scores in the matrix represented the status and properties of the impacts (Mousavi *et al*., 2012).

ICOLD matrix has the ability to specify the impacts of projects as an organized method with a tight framework. Specially, this matrix examines the impacts types (long-term, med-term and short-term) and can measure construction and operation phases separately. This method carries out the EIA based on the impact intensity, project goals, project type and the covered area. Another reason to choose ICOLD matrix for EIA, was the need for subject-matter specialists familiar with the study area. There is the fact that it calls for subject-matter specialists

Table 1: Description of types of effects in ICOLD matrix

Row	Types of effects
A	Type of effect: + and – marks illustrate positive and negative effects, respectively.
B	Degree of effect: It represent level of changes with respect to the current status, i.e. in this research the changes level were considered as very high, high, average, low, and very low, which are shown with the numerical symbols 5, 4, 3, 2 and 1.
C	Continuity of effect: Transient effects occurred at an especial time and don't have continued for long time. They are represented by T symbol. Permanent effects are long term effects and they are represented by P symbol.
D	Time of occurrence: The three symbols of I, M, L are immediate, medium-term and long-term effects, respectively.

and in most administrations and consulting engineering companies, consensus is a need for EIA. EIA was conducted by a research team comprised of a water structures expert, a geology expert, a water resources expert, an expert of environment and a socio-economic expert. Finally, regarding all aspects of a project, an analysis was made for the project implementation or otherwise. At the confluence of activity components and environment parameters if there is an effect in force, the type of effect quality is expressed by using Table 1.

Features of Kavar irrigation and drainage network

The irrigation and drainage network of Kavar plain consisted of three sectors: right, middle and left sectors. The right sector encompassed six villages. It covers 4050 hectares. The right sector included five primary canals (PC), 10 secondary canals (SC) and 62 tertiary canals (TC). Also, this sector has two primary drainages, 10 secondary drainages and 164 tertiary drainages. The middle sector covered seven villages. The covered area by the network is 3150 hectares. The middle sector contains five PCs, eight SCs and 34 TCs. Also, the drainage network includes a primary drainage, four secondary drainages and 32 tertiary drainages. The left sector covered seven villages. Its area is 4880 hectares. This sector contains two PCs, 11 SCs and 65 TCs. Also, drainage network has two primary drainages, six secondary drainages and 68 tertiary drainages.

RESULTS AND DISCUSSION

As further described, ICOLD matrix was used to analysis of the environmental components. In this regard, the algebraic sum of the values for each column is calculated and then it divided by the number of available values and the average rating was calculated for each of activities. To calculate the average rankings for each of the three areas the values sum of all the columns were divided by the number of effects. Finally, the overall average rating for each stage of construction and operation obtained through the algebraic sum of all the average ranking was divided by the number of environments. The results showed that excavation and embankment proceedings, borrow resources and building roads have more negative impact on the physical aspect, during construction phase (Table 2). The excavation and embankment proceedings, borrow resources and construction waste have greatest negative impact on the ecological aspect, respectively (Table 3). Most actions have a positive impact on the socio-economic aspect in the construction of irrigation and drainage network. The roads of access, electricity supply and transmission and construction of structures had more positive impact, respectively and only construction waste have negative effects (Table 4). The cultural environment as well as excavation and embankment proceedings and construction waste generated the most negative effects, respectively (Table 5).

In The operation phase, two activities of flood control, water supply and repair and maintenance of structures have most positive impact, respectively. Also, the uses of fertilizers and pesticides have a negative effect on the physical environment (Table 6). However, the two activities of flood control and launching of green spaces have greatest positive impact on the ecological aspect and the recreational activities development and using fertilizer have the greatest negative impact (Table 7). In the operation phase of irrigation and drainage network, all activities have positive impact on the socio-economic environment. So that, water supply and flood control have more positive impact (Table 8). The three active cultural environments, flood control, water supply and recreational activities development have the greatest positive impact on the cultural aspect (Table 9).

Table 2: Prediction matrix of physical impacts of irrigation and drainage network in construction phase

Action / Environmental parameters	Worker employment	Staff transportation	Building roads	Construction & tooling workhouse	Excavation & embankment	Construction waste	Concreting	Borrow resources	Materials transportation	Electricity supply and transmission	Waste excretion	Green spaces creation	Drainages	Structures construction
Air quality		-1TM	-3 TM	-1TM	-4 TI		-2 TI	-2 TI	-2 TI			+4 PL		
Environment sound			-2 TI		-4 TI		-2 TI	-3 TI	-2 TI					
Dehydration regime														−3PL
Flood regime														+2PM
Surface water quality					-1 TI						-1PM			
Groundwater quality											-1PM			
Soil salinity														
Surface water consumption												-1PI		+2PM
Groundwater consumption										-2 TI				+3PM
Land form			-2PM		-4PI		-1 PI	-2 PI						
Soil erosion			-2PM		-5PI			-3PI	-2PM					
Total	0	-1	-9	-1	-18	0	-5	-10	-6	-2	-2	13	0	110

Table 3: Prediction matrix of ecological impacts of irrigation and drainage network in construction phase

Action / Environmental parameters	Worker employment	Staff transportation	Building roads	Construction & tooling workhouse	Excavation & embankment	Construction waste	Concreting	Borrow resources	Materials transportation	Electricity supply and transmission	Waste excretion	Green spaces creation	Drainages	Structures construction
Aquatic ecosystem					-3PI	-1PM	-2TI				-3PM	+2PL	+1PL	
Terrestrial ecosystems		-2PM	-1TI	-5PI	-1TM	-1PI	-3PM			-2PM	+3PL			
Animal emigration			-1PM	-3TM	-4PI		-1PI	-2PI				+3PM		
Animal habitat			-1PM	-2TI	-3PI		-1PI	-2PI				+3PM		
Plants habitat			-2PI	-1TI	-3TI	-2TM	-2PI	-2PI				+5PM		
Vermin					-1TI	-4PM								
Pests & weeds					+1TM									
Disease vectors					-2TM	-4TM								
Total	0	0	-6	-7	-20	-8	-7	-9	0	0	-5	+17	+1	0

Table 4: Prediction matrix of socio-economic impacts of irrigation and drainage network in building phase

Action / Environmental parameters	Worker employment	Staff transportation	Building roads	Construction & tooling workhouse	Excavation & embankment	Construction waste	Concreting	Borrow resources	Materials transportation	Electricity supply and transmission	Waste excretion	Green spaces creation	Drainages	Structures construction
Population			+3TL							+2TL		+3TL		
Migration	+3TM		+3PM							+2PM		+3TM		
Income & expense	+3TI	+1TI	+4PM	+1TI						+2PM				
Employment & unemployment	+3TI	+2TI	+2PM	+2TI						+1PM				
Real estate price			+2TM	+1TI	+1TI		+1TI							
Agriculture			+3PM			-1PI				-2PI			+4PM	+5PM
Industry of area			+4PL							+4PM				
Services			+3PI							+2PM				
Transportation			+5PI											
Participation of users			+2PM	+1TM						+2PM				+2PI
Welfare			+3PL							+3PM		+1TM		
Water consumption										-4TI		-4PI		+4PM
Leisure times												+4PI		
Security										+1PM				
Land use										+1TM			+1PM	+4PM
Future development projects			+3PL							+3PL				
Social acceptance			+1TM			-2TI				+1PM		+2PM		+1PM
Total	+9	+3	+38	+5	+1	-3	+1	0	0	+22	0	+7	+5	+16

Table 5: Prediction matrix of cultural impacts of irrigation and drainage network in construction phase

Action / Environmental parameters	Worker employment	Staff transportation	Building roads	Construction & tooling workhouse	Excavation & embankment	Construction waste	Concreting	Borrow resources	Materials transportation	Electricity supply and transmission	Waste excretion	Green spaces creation	Drainages	Structures construction
Hygienic indicators					-4TI	-4TI			-1TM			+2PL		
Educational indicators			+1PM							+1PM				
Diseases & illnesses					-4TM	-3TM		-1TL		-2TM	+1PL			
Water drinking & water supply quality														
Tourism			+3PM		-5PI	-5PI			-2PM	+2PM	-2PM	-1PI		
Educational services			+2PM							+3PM				
Religious buildings					-3PL	-2PL								
Landscape & sights					-5TI	-4TI						-4PI		
Total	0	0	+6	0	-21	-18	0	0	-4	+6	-4	+8	0	0

Table 6: Prediction matrix of physical impacts of irrigation and drainage network in operation phase

Action / Environmental parameters	Water supply	Torrent control	Recreational activities development	Using pesticides	Using fertilizers	Distribution & use of water	Launching of green spaces	Maintenance of access routes	Repair & maintenance of structures
Air quality	+1PL						+5PM	+1PL	
Environment sound								-3PM	
Dehydration regime	+5PL	+4PM							+4PL
Flood regime		+5PM							+3PL
Surface water quality	+1PM	+4PM		-2TI	-2TI				
Groundwater quality	+2PM	+3PI		-4PM	-4PM				
Soil salinity	+3PL				-3PM		+1PL		
Surface water consumption	-3TI			-2TM	-2TM	-1TI	-2MI		+4PM
Groundwater consumption	+4PM	+1PM				+1PM			+4PM
Landform		+3PL							
Soil erosion	+2PM	+5PI					+3PM	+1PL	
Total	+15	+25	0	-8	-11	0	+7	-1	+15

Table 7: Prediction matrix of ecological impacts of irrigation and drainage network in operation phase

Action / Environmental parameters	Water supply	Torrent control	Recreational activities development	Using pesticides	Using fertilizers	Distribution & use of water	Launching of green spaces	Maintenance of access routes	Repair & maintenance of structures
Aquatic ecosystem	+3PM	+4PI		-3PL	-3PL		+1PL		
Terrestrial ecosystems	+1PM	+5PM	-2PL	-1PL	-1PL		+4PM		
Animal emigration	+1PM	+3PM	-1PL				+3PM		
Animal habitat	+1PM	+4PM	-3PL				+4PL	-1PL	
Plants settlement	+2PM	+4PM	-3PM				+4PM	-1PM	
Vermin									
Pests & weeds					+2TI	-2TI		-2TM	
Disease vectors		+3PM		-3PL	-2PL				
Total	+8	+23	-9	-5	-8	0	+14	-2	0

Table 8: Prediction matrix of socio-economic impacts of irrigation and drainage network in operation phase

Action / Environmental parameters	Water supply	Torrent control	Recreational activities development	Using pesticides	Using fertilizers	Distribution & use of water	Launching of green spaces	Maintenance of access routes	Repair & maintenance of
Population	+2PL	+2PL				+1PL		+2TL	
Migration	+5PM	+4PI	+3PM			+2PM		+2PM	+1PL
Income & expense	+4TM	+1PM							
Employment & unemployment	+3TL	+1TL						+1PM	+1PM
Real estate price	+2TI							+2TM	
Agriculture	+5PI	+5PI		+3PI	+3PI	+1PI		+2PM	+4PM
Industry of area	+2PL	+3PL						+3PL	
Services	+1PM	+3PI						+1PM	
Transportation								+5PI	
Participation of users	+4PM	+1PI	+1TM					+1TM	+4PM
Welfare	+3TL	+1TL	+2TM			+1TL		+3PM	
Water consumption	-3TI			-3PI	-3PI	-3PI	-2PI		+4PM
Leisure times			+5PI				+2PI		
Security									
Land use	+4PM	+3PM				+3PI			+2PM
Future development projects	+2PM	+3PM						+4PM	
Social acceptance	+4PM	+3PI	+3TL						+3PM
Total	+38	+30	+14	0	0	+5	0	+26	+19

Table 9: Prediction matrix of cultural impacts of irrigation and drainage network in operation phase

Action / Environmental parameters	Water supply	Torrent control	Recreational activities development	Using pesticides	Using fertilizers	Distribution & use of water	Launching of green spaces	Maintenance of access routes	Repair & maintenance of structures
Hygienic indicators	+2PI	+3PI		-4PI	-4PI				
Educational indicators								+1PM	
Diseases & illnesses	+1PM	+4PM	+3PL	-5PL	-5PL		+3PL		
Water drinking & water supply quality		+3PL		-3PM	-3PM				
Tourism	+3PL	+4PL	+4PL				+2TL	+2PL	
Educational services	+1TM	+3TM						+1PI	
Religious buildings		+4PM							
Landscape & sights	+4PL	+3PL	+3TM				+4PL		
Total	+11	+24	+10	-12	-12	0	+9	+4	0

Generally, findings indicated that positive permanent effects were more than negative effects on the physical environment, but negative transient effects were more than positive effects. In general, negative transient effects were more than the negative permanent effects and positive permanent effects were more than positive transient effects. However, by comparing the sum of positive and negative consequences on the physical environment was found that the construction and operation of irrigation and drainage network have negative effects more than positive effects on the physical environment (Table 10).

Findings showed that negative permanent effects have more than positive effects on the ecological aspect. The positive transient effects have less than negative transient effects. In general, by comparing the sum of positive and negative effects on the ecological aspect concluded that negative effects have more than positive effects with the construction and operation of irrigation and drainage network (Table 11).

The findings of effects on the socio-economic aspect indicated that negative positive permanent effects were more than negative effects. Also, the negative transient effects have less than positive transient effects. In general, by comparing the sum of positive and negative effects on the socio-economic aspect, it became clear that the negative effects of the construction and operation of irrigation and drainage network will be less than positive effects (Table 12).

The results of the effects on the cultural aspect showed that positive permanent effects were more than negative permanent effects. However, the negative transient effects were more than positive transient effects. In general, by comparing the sum of positive and negative effects in the cultural environment was found that the positive effects of construction and operation of irrigation and drainage network will be more than negative effects. But, there is not more difference between the positive and negative effects (Table 13).

Table 10: Summary of physical impacts of Kavar irrigation and drainage network

Environmental parameters / Impacts	Air quality	Environment sound	Dehydration regime	Flood regime	Surface water quality	Groundwater quality	Soil salinity	Surface water consumption	Groundwater consumption	Landform	Soil erosion	Total
Number of positive impacts of P	4	0	4	3	2	2	2	2	5	1	4	29
Number of negative impacts of P	0	1	0	0	1	3	1	1	0	4	4	15
Total of positive values of P	11	0	16	10	5	5	4	6	13	3	11	84
Total of negative values of P	0	3	0	0	1	9	3	1	0	12	15	44
Number of positive impacts of T	0	0	0	0	0	0	0	0	0	0	0	0
Number of negative impacts of T	7	5	0	0	3	0	0	5	1	0	0	21
Total of positive values of T	0	0	0	0	0	0	0	0	0	0	0	0
Total of negative values of T	15	13	0	0	5	0	0	10	2	0	0	45
Total number of positive impacts	4	0	4	3	2	2	2	2	5	1	4	29
Total number of negative impacts	7	6	0	0	4	3	1	6	1	4	4	36
Total of positive values	11	0	16	10	5	5	4	6	13	3	11	84
Total of negative values	15	16	0	0	6	9	3	11	2	12	15	89

Table 11: Summary of ecological impacts of Kavar irrigation and drainage network

Impacts \ Environmental parameters	Aquatic ecosystem	Terrestrial ecosystems	Animal emigration	Animal settlement	Plants settlement	Vermin	Pests & weeds	Disease vectors	Total
Number of positive impacts of P	5	4	4	4	4	0	0	1	22
Number of negative impacts of P	5	8	5	6	5	1	0	2	32
Total of positive values of P	11	13	10	13	15	0	0	3	65
Total of negative values of P	13	17	9	11	10	4	0	5	69
Number of positive impacts of T	0	0	0	0	0	0	2	0	2
Number of negative impacts of T	1	2	1	1	3	1	2	2	13
Total of positive values of T	0	0	0	0	0	0	3	0	3
Total of negative values of T	2	2	3	2	6	1	4	6	26
Total number of positive impacts	5	4	4	4	4	0	2	1	24
Total number of negative impacts	6	10	6	7	8	2	2	4	45
Total of positive values	11	13	10	13	15	0	3	3	68
Total of negative values	15	19	12	13	16	5	4	11	95

Table 12: Summary of socio-economic impacts of Kavar irrigation and drainage network

Impacts \ Environmental parameters	Population	Migration	Income & expense	Employment & unemployment	Real estate price	Agriculture	Industry of area	Services	Transportation	Participation of users	Welfare	Water consumption	Leisure times	Security	Land use	Future development projects	Social acceptance	Total
Number of positive impacts of P	3	8	3	4	0	11	5	5	2	6	3	2	3	1	6	5	6	73
Number of negative impacts of P	0	0	0	0	0	1	0	0	0	0	0	5	0	0	0	0	0	6
Total of positive values of P	5	22	7	5	0	37	16	10	10	15	9	8	11	1	17	15	14	202
Total of negative values of P	0	0	0	0	0	1	0	0	0	0	0	15	0	0	0	0	0	16
Number of positive impacts of T	4	2	4	5	6	0	0	0	0	3	5	0	0	0	1	0	2	32
Number of negative impacts of T	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	3
Total of positive values of T	10	6	9	11	9	0	0	0	0	3	8	0	0	0	1	0	4	61
Total of negative values of T	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	2	9
Total number of positive impacts	7	10	7	9	6	11	5	5	2	9	8	2	3	1	7	5	8	105
Total number of negative impacts	0	0	0	0	0	1	0	0	0	0	0	7	0	0	0	0	1	9
Total of positive values	15	28	16	16	9	37	16	10	10	18	17	8	11	1	18	15	18	263
Total of negative values	0	0	0	0	0	1	0	0	0	0	0	22	0	0	0	0	2	25

Table 13: Summary of cultural impacts of Kavar irrigation and drainage network

Impacts \ Environmental parameters	Hygienic indicators	Educational indicators	Diseases & illnesses	Water drinking & water supply quality	Tourism	Educational services	Religious buildings	Landscape & sights	Total
Number of positive impacts of P	3	3	5	1	7	3	1	4	27
Number of negative impacts of P	2	0	2	2	4	0	2	0	12
Total of positive values of P	7	3	12	3	19	6	4	15	69
Total of negative values of P	8	0	10	6	14	0	5	0	43
Number of positive impacts of T	0	0	0	0	1	0	0	1	2
Number of negative impacts of T	3	0	4	0	0	0	0	2	9
Total of positive values of T	0	0	0	0	2	0	0	3	5
Total of negative values of T	9	0	10	0	0	0	0	9	28
Total number of positive impacts	3	3	5	1	8	3	1	5	29
Total number of negative impacts	5	0	6	2	4	0	2	2	21
Total of positive values	7	3	12	3	21	6	4	18	74
Total of negative values	17	0	20	6	14	0	5	9	71

CONCLUSION

Lack of attention to environmental considerations in development planning and implementation of projects caused environmental impacts in many countries of the world. As a result of this neglect, the quality of the natural and human environment had decreased and destruction of natural resources and greatly reduce public grievances has brought. This is mainly due to ignore environmental rules and regulations in Iran now, day after day take a wider dimension. This study aimed to examine the biological, socio-economic, cultural and physical construction of irrigation and drainage network Kavar plain in Fars province, Iran. Results showed that the total number of positive effects of irrigation and drainage network in physical, ecological, socio-economic and cultural environments were 187 scores. Socio-economic environment had the largest number of positive impacts with 105 score. About the number of negative effects (111 score), most of them were ecological effects (45 score), and others were the physical environment (36 score) and cultural environment (21 score). Total values of Kavar irrigation and drainage network included 489 positive score and 280 negative score. Socio-economic environment had the greatest positive effect (263 score), and after it, physical environment (84 score), cultural environment (74 score) and ecological environment (68 score) had positive effects, respectively. Also, ecological environment received the most negative effects from project (95 score). While socio-economic environment received the least negative effects (25 score). Finally, the sum value indicates that the physical and ecological environment had negative impacts and socio-economic and cultural environment had positive impacts. But, sum of the effects were positive impacts on the whole environment (+219 score) in four environments (Table 14). Therefore, the implementation of Kavar irrigation and drainage network is permitted with use of standards. The findings of this study are consistent with the results of Mohammadi *et al*. (2009), Monavari *et al*. (2012), Piri (2012), and Nikbakht and Shahmohammadi (2004).

In order to reduce the negative impact on the environment, suggestions and corrective action is necessary. As a result, to reduce the negative environmental consequences of the action plan following is recommended:

- Air and surface water quality will be affected with the beginning operations of excavation and embankment. Also, soil erosion can result. As well as land and water ecosystems, plant and animal species and their habitats are changed. Therefore, it should proper planning, at least in excavation and embankment operations, especially in the rainy months, conducted and enforcement actions taken in traditional streams.

▪ The planning to begin construction should be avoided in protected areas or sensitive periods (during reproduction of plants and animals).

▪ Development of recreational activities will be negative affect on aquatic and terrestrial ecosystems and habitats of plants. In regarding to the protected area by the organization of natural resources and the environment in the study area, it is of utmost importance that the introduction of human factors on the natural environment, nature will change. Therefore, to reduce the negative impacts of recreational activities can be used to install warning signs and educate people by the trainers.

▪ Operation of irrigation and drainage network increased the using of pesticides and fertilizers by the farmers that it would have negative effects on groundwater and quality of surface water and aquatic ecosystem.

As a result, the farmers are trained to low use pesticides and fertilizers through coordinating by Organization of Agriculture Jahad. Also, they are encouraged to use crop residuals and animal manure and biological control of pests instead of pesticides.

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CONFLICT OF INTREST

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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