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ORIGINAL PAPER

A perspective analysis about the effects of dams - Evidence from Iran

Hoshmand Farzi[1]; Mohammad Sadegh Ebrahimi[2]* & Hossein Daneshmehr[3]

[1]Postgraduate student of Rural Development, College of Agriculture, Isfahan University of Technology, Iran
[2]Assistant Professor, Rural Development Department, College of Agriculture, Isfahan University of Technology, Iran
[3]Assistant Professor, Faculty of Humanities and Social Sciences, University of Kurdistan, Iran

Abstract: The construction of dams is one of the main mechanisms undertaken by policy makers for managing the challenge of water scarcity in recent decades, but this strategy can lead to negative social, economic and environmental consequences. The purpose of this study was to investigate a perspective analysis about the effects of construction of the dam on the Sirvan River in Iran. A sample of 273 rural households was selected using Cochran's formula by use of multi stage sampling technique. In the mentioned villages, 36 key-informants were selected and interviewed. The results showed that the residents of rural areas were dissatisfied with the construction of the dam. Daryan dam construction in the region, in the social dimension, reduced the components of social capital by nearly 20%; in the economic dimension, reduced the economic components by nearly 24%; but in the infrastructure dimension, has improved the infrastructure of rural areas by only 4%. The results of t-test also show that the effect of dam construction in both economic and social dimensions was significant from the viewpoint of villagers and key-informants. The research results show significant negative effects of dam construction on social capital, trust and social participation. The viewpoint of villagers and key informants Daryan dam construction reduced the area under cultivation and production of the villagers of the region. However, in terms of infrastructure indicators, it has not been able to create positive and significant effects on the well-being of the villagers in the region.

Keywords: Economical characteristics, infrastructural characteristics, social characteristics, key-informants, villagers.

Introduction

With the change of human perspective from interaction with nature to overcoming it and the beginning of the industrial revolution, dam construction began as one of the manifestations of new technology in most countries of the world. Nowadays, supply suitable water is the basic subject of

* Corresponding author: E-mail: Ebrahimi_ms@iut.ac.ir
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development in different countries in the world (Carrard et al., 2019). Due to rapid population growth and increasing water demands, including drinking, industrial and agricultural sectors, it is required a robust management to optimize the use of water resources (Neway and Zegeye, 2022; Temesgen et al., 2022).

In all countries of the world, dams have been made with different goals, such as: agriculture, water supply, power generation, flood reduction, etc. Although the roots of dam construction in Iran date from the period of ancient Iranian civilization, but dam construction in its industrial and modern sense began with the developments of the 1960s and simultaneously with land reform in Iran (Akbarzadeh and Kaboli, 2017). After land reform in Iran in the 1960s and the existence of surplus oil revenues, most large dams in Iran were built to control water for agriculture or to use water power to generate fast electricity (Harris and Kalb, 2019).

Due to the arid climate of Iran and less annual rainfall than the global average, at first it seemed that dam construction could be an effective solution for the development of Iran's agricultural sector. But gradually, with the identification of the negative effects and consequences of dam construction, and the view of sustainable development in the agricultural sector, reformist views were formed. However, the material and monetary benefits of large-scale projects in developing countries still prevent them from creating the right perspective on locating, implementing, and evaluating dams (Schulz et al., 2017).

Dams are important tools to achieve the development goals but these goals are not easily acceptable for the people whose agricultural areas, houses and the environment they are living in go under water in rural areas. Although in several years after dam construction we could compare harms and benefits for a long period of time, and could be judged and decision can be given about dams. Dams similar the others engineering structures in development may be the unwanted side effects negative or positive, will be no longer in force because of the benefits in the future (Chu and Karr, 2013; Hoechstetter et al., 2016).

But the experiences gained these big engineering structures should remind us that we are not able to change only a part of the ecosystem whatever we want. Because rivers are small parts of ecosystem and whole chains are connected together in the ecosystem. We need to know and understand that even only a link breaking out of the chain or a piece coming out of the cog will destroy the whole system. So, the environment subject should be studied, evaluated and examined in detail at the planning stage and after the construction. In the base of research result about the specific projects, precautions should be taken beforehand to big hazards caused by the littlest sensitive responses (Beck et al., 2012).

The rural development process goals are to better condition for rural settlement and other population of society but mired by difficulties mainly caused of unrealistic expectations, inadequate definition of goals, and a lack of central government responsibility for the process. The historical background of the development process, especially in developing countries has shown that, the rural residents are often excluded from policy decisions about key determinants of their communities' development and well-being (Langille et al., 2008).

It is necessary to use the views and opinions of rural people in the construction of large engineering structures such as dams, which is done in order to create rural development. While positive and negative social and environmental impacts of dams are increasingly well understood, little is known about attitudes of the general public towards dams, even though benefits to wider society are often cited to legitimize their construction (Schulz, 2019).

Daryan dam constructed on the Sirvan River just north of Daryan village in Paveh County in Iran. The primary purpose of the dam is to supply up to 1,378,000,000 m^3 of water annually to the 48 km long Nosoud Water Conveyance Tunnel where it will irrigate areas of Southwestern Iran. The dam is also the subject of protest due to the forced relocations and ecological/cultural impact its reservoir will have (IWRMC, 2015).

World Commission on Dams (WCD), established in 1997 with a mandate to: the first thing to consider is the effectiveness of large dams as a development option, and the evaluation of alternatives for the development of water and energy resources. the second consideration is the development of internationally accepted standards, guidelines and standards for the planning, design, evaluation, construction, operation, monitoring and dismantling of dams.

The third thing to consider is that, like any construction project, dams and their alternatives must meet a wide range of needs, expectations, goals, and constraints. Therefore, this case can be achieved only by changing the development process, so that it includes all relevant stakeholders and is based on negotiations and consensus decisions. To achieve such a goal, all stakeholders, especially villagers, must have a clear understanding of the agreement on common goals and development goals, which must be based on the five core values according to WCD, namely equity, efficiency, participatory decision-making, sustainability, and accountability.

Ashraf et al. (2007) examined the construction of three small dams in Pakistan and concluded that the construction of small dams could have a positive impact on the well-being of rural residents. So that after the construction of these dams, harvest and yield per unit area has increased.

Amini and Qvaqlv (2012) studied the spatial reflections of the construction of the dam on the surrounding areas. The results of studies show that the Khordad dam has caused negative environmental effects, the loss of the previous water rights of the villages and the restriction of agricultural water supply in the downstream villages. Also, the construction of the dam has changed the cultivation pattern in the downstream villages. The cultivation pattern in the desired area has shifted from agriculture to horticulture.

Wajid et al. (2013) in a study entitled "Socio-economic impact of small dams on the proximity of local villagers" concluded that after the construction of the dam in the region, crop yield, livestock production and income of villagers have increased significantly. The traditional cultivation pattern has been transferred to market-oriented crops while the yield of almost every crop has improved. The water level has improved and the wells have been recharged, because before the construction of the dam, people faced severe shortages of water for domestic use.

In the study carried out by Chen et al. (2016), the world was divided into three categories and stated that the construction of dams in third world countries is necessary due to the needs and pressures of increasing population. However, economic, social and necessary environmental measures should be taken to reduce the negative effects of the construction of dams.

Sadeghi et al. (2017) investigated the environmental effects in the Karun-3 Dam on surrounding rural areas. Based on the findings of research showed that evaluation of environmental variables in rural areas upstream from expert opinion shows, the situation is not only not improved after the dam, but has worsened. The results of interviews with the villagers showed that the negative effects were due to improper project management and lack of use and consideration of local people, and this has led to a lack of proper knowledge of the local ecosystem, the negative environmental effects of the project to increase.

Hosayni et al. (2017) studied the social impacts of Solaiman Shah Dam on its surrounding villages using social impact

assessment tool. Research result showed that however, although the subjective well-being has been significantly improved for the majority of residents, the construction of dam was also followed by objecting voices, caused by unfair share of dam benefits which complicated the relations between neighboring villages, produced cultural disruption and obligatory resettlement of some peasants jeopardizing the social sustainability of the project.

Amini et al. (2018) analyzed the impact of dam construction on the livelihood of rural households in the Darian Dam area. The results showed that the construction of the dam affects the livelihood of rural households living in the area. According to the families, their livelihood has decreased with the construction of Daryan Dam. The villagers believed that before the dam was built, their living conditions and even their health and longevity were better.

Bhatti et al. (2018) studied the socio-economic impact assessment of small dams in Pakistan, the results summary of the research showed that the small dams have a positive impact on land cover change, agriculture, houses, water level, time, distance, livestock, income, expenditure, saving and migration rate in direct and indirect way and also play very important role on the socio-economics conditions of the settled communities of the arid area.

Naderi and Karami (2019) investigated the views of local households regarding the possible consequences of the construction of the BeheshtAbad dam on their agricultural and non-agricultural livelihood strategies. This research showed that from the view of local rural and urban communities, if the dam is constructed, their physical assets would be damaged and their jobs would be destroyed, though a few new jobs related to industry and service may be created.

Schulz et al. (2018) analyzed the public preferences for strategies to manage dam impacts in the area by investigating the value base that underpins such preferences, drawing on the recently proposed value landscapes. Research shows that the majority of members of the general public would prefer concentrating dam construction on some rivers while keeping others free-flowing, with direct implications for ecosystems and inland fisheries.

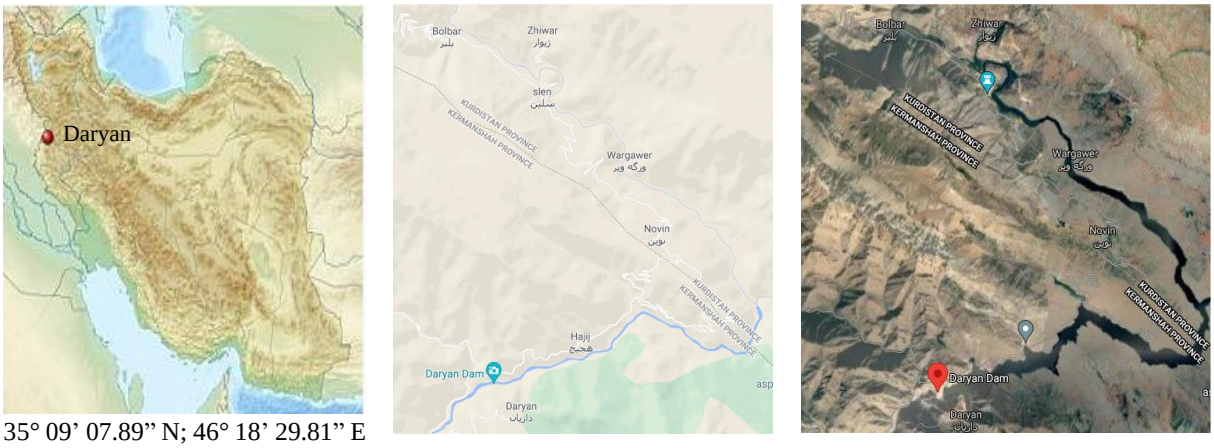
Amini (2020) analyzed the social and cultural challenges of dam construction in rural areas of Horaman in Iran. The results shows that the most important challenges in the study area are the threat to traditional, cultural and social systems and to some extent the livelihood of people in rural areas, which leads to fear of loss of identity, loss of solidarity and threat to horticultural systems, architecture and language. On the other hand, the disappearance of local customs and thus the indirect reduction of social capital is another negative consequence of the construction of the dam in the Horaman region.

The main purpose of this study is to investigate the effects of dam construction in countries and especially its impact on rural and agricultural areas in the surrounding area as a case study of Daryan Dam in Iran.

Material and Methods

Area description and type of study

This study was a descriptive-correlational applied research based on an exploratory survey methodology. Moreover, some semi-structured interviews were conducted with some experts of the province and key persons of local communities to obtain background information about the region and topic, to improve the content validity of survey instrument. The data were collected through the structured interview technique with households living in local communities under the influence of the construction of the Daryan dam (Figures 1-3 and Table 1) using a questionnaire, established by the research team.



35° 09’ 07.89” N; 46° 18’ 29.81” E

Figure 1: Location of Daryan dam and studied villages.

Figure 2: Daryan village in Iran.

Figure 3: Daryan dam under construction on the Sirwan River in Iran.

Table 1: Daryan dam characteristics

Dam name	River name	Heigh t (m)	Purpose	Completion date
Daryan	Sirwan	169 m	Irrigation and power	2010

Source: Al-Ansari and Adamo (2018).

Data collection and sampling techniques

In this study, stratified sampling with proportional assignment was used. Cochran’s equation was also used to determine the sample size, which is one of the most widely used methods in determining the sample size, as shown below.

$$n = \frac{\frac{Z^2 pq}{d^2}}{1 + \frac{1}{N}\left[\frac{Z^2 pq}{d^2} - 1\right]} \quad (1)$$

Where: n – number of research samples (273); Z^2 = 1.96; p = 0.5; q = 0.5; d^2 – sampling accuracy (0.05 to 0.1) (0.055); N

– number of research statistical population (1438).

This study was carried out in 10 villages, two of which were in Kermanshah province (Hajij and Daryan) and the rest in Kurdistan province (Zhiwar, Bolbar, Selen, Novin, Naw, Kalji, Ravar, and Zom) in Iran (Table 2). In the mentioned villages, 36 key-informants were selected and interviewed. So that from each village, three to four influential and informed people were selected and the necessary information was obtained from them.

In this research, the data collection tool in field studies was a questionnaire that was prepared and implemented according to the objectives of the research and according to the indicators introduced in the sustainable development model. The questionnaire was used after the preliminary test and to ensure its reliability and validity (Sarmad et al., 2014). The variables were divided into three categories, namely social, economic and infrastructure categories for the four items in the questionnaire that category and were presented (Table 3).

Cronbach's alpha – a (Equation 2) was used to assess the reliability of the questionnaire questions. The Cronbach's alpha coefficient for the category of the total questionnaire questions was 0.761. Thus, the reliability of the questionnaire was confirmed. Cronbach's alpha for the whole questionnaire was 0.810.

$$a = \frac{k}{k-1}\left[1 - \frac{\sum_{=1}^{k} s_{i^2}}{\sigma^2}\right] \quad (2)$$

Where: k – number of ques tions per component; s_i – variance of each component; σ^2 – total variance of the test.

The Kaiser-Meyer-Olkin (KMO) test was used for determining the factor validity of the research instrument (questionnaire), which was appropriate. The value of KMO was larger than 0.5 (Table 4). Therefore, it is concluded that the number of samples was suitable for the factor analysis. The reason is that KMO value is ranged between zero and one, in which the closer to one, the higher the sample validity (Öcal et al., 2007).

Table 2: The number of interviewees in selected rural in research areas

Province	City	Village name	Population	Rural household	Number of questionnaire	Number of interviewees
Kermanshah	Paveh	Daryan	530	165	35	4
		Hajij	310	102	28	4
Kurdistan	Sarvabad	Zhiwar	1314	320	27	4
		Belbar	552	148	27	4
		Selen	707	203	34	4
		Novin	746	215	35	4
		Naw	570	140	26	3
		Kalji	197	62	21	3
		Ravar	166	65	23	3
		Zom	90	18	17	3
Total			5242	1438	273	36

Table 3: Cronbach's alpha coefficient of the principles studied in the research

Indicators	Number of item	Cronbach's alpha coefficient	Number of item	Cronbach's alpha coefficient
	The view point of rural residents		The view point of key information	
Social effects	8	0.754	10	0.774
Economic effects	5	0.639	8	0.664
Infrastructural effects	6	0.724	10	0.074

Table 4: KMO measurement and Bartlett's test used to assess the appropriateness of the research instrument (questionnaire)

Scale Name	KMO	Bartlett's test of sphericity	
Social effects	0.701	Approx. Chi-square (1425.312)	Sig (0.000)
Economic effects	0.752	Approx. Chi-square (1057.540)	Sig (0.000)
Infrastructural effects	0.706	Approx. Chi-square (1217.291)	Sig (0.000)

Data analysis

The data of the study were analyzed both quantitatively and qualitatively. The quantitative data were analyzed using various statistical tests based on the level of measurement of the variables involved. Statistical package for social sciences (SPSS-IBM) software, version 21, was used to analyze of the data.

Results and Discussion

According to Trochim (2006) and Bhatti et al. (2019), the descriptive statistics are very important and useful for describing the basic features of demographic data such as age, education, and also show or summarize the data in a meaningful way. Table 5 shows the general information of the respondents in frequencies and percentage.

Descriptive analysis

The result of research showed that the 96.3% of the respondents are married (Table 6). Also, only about 20% of rural people had a university degree. The maximum age of the respondents was 66 years and the minimum was 25 years, and the average age of respondents in this community was of 41.3 years. Also, during the construction of Daryan dam in the region, about 57% of the respondents admitted that they had a job and business in its construction.

Table 5: Name and type of measured variables

Components	Variable name	Scale	Unit
Individual characteristics	Age	Relative	0-100
	Sex (male = 1, female = 0)	Nominal	0-1
	Work experience	Relative	0-30
	Level of education (illiterate = 1, under diploma = 2, diploma = 3, degree = 4, master's degree or higher = 5)	Ranking	1-5
	Family members	Relative	1-10
Agronomic characteristics	Land ownership (owner = 1, rental = 2, sharing = 3)	Nominal	1-3
	Acreage	Relative	0-20
	Average of production	Relative	0-100
Economical characteristics	Income (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	Occupation (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	New investment (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	Product diversification (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	Reduce unemployment (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	The rising cost of land (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	Public investment (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	Private investment (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5

Table 5: (continued)

Components	Variable name	Scale	Unit
Social characteristics	Reducing migration (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	Partnership (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	Health services (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	Amenities (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	Access to agricultural services (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	The satisfaction of the dam (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	The impact of disputes (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	Create a sense of cooperation (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
Infrastructural characteristics	Convenient access to the road (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	Drinking water quality (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	Proper access to educational centers (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	Proper access to medical centers (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	Quality of rural housing (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	Quality of rural alleys (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5
	Improving the village landscape (very low = 1, low = 2, middle = 3, high = 4, very high = 5)	Ranking	1-5

Table 6: Description of the characteristics of villagers

Variables	Frequency	Percent	Cumulative percent
Marital status			
Married	263	96.3	96.3
Single	10	3.7	100
Total	273	100	
Illiterate	23	7.7	7.7
Elementary literacy	94	35.1	42.8
Diploma	102	37.3	80.2
University literacy	54	19.8	100
Total	273	100	-
Age (years)			
< 30	20	7.3	7.3
30-40	118	43.2	50.5
40-50	91	33.3	83.9
> 50	44	16.1	100
Total	273	100	-

Table 6: (continued)

Variables	Frequency	Percent	Cumulative percent
Acreage (ha)			
0.5 <	61	22.3	22.3
0.5-1	30	11.1	33.4
1-2	46	16.6	50.0
2-3	126	46.3	96.3
> 3	10	3.7	100
Total	273	100	-
Job status			
Farmer	82	30.1	30.1
Livestock	19	7.0	37.1
Government's employee	27	9.9	50.0
Manual worker	56	20.5	67.5
Unemployed	4	1.6	68.4
Other	85	31.4	100
Total	273	100	-

Satisfaction with the construction of the dam was also assessed from the perspective of villagers and key informants in rural communities (Table 7). The results showed that about 77% of rural people and key informants are not very satisfied with the construction of the dam. So that, only 7% of the villagers expressed their satisfaction with the construction of the Daryan dam. The views of people in different villages can be seen in three dimensions: social (Table 8), economic (Table 9), and infrastructure (Table 10).

As shown in Table 8, from the point of view of villagers and key informants in the region, the construction of Daryan dam in the social dimension has reduced the level of cooperation and participation of villagers and has increased the conflict between them. Based on the research findings shown in the Table 9, villagers and key informants believe that from an economic point of view, the construction of the Daryan dam has reduced the area under cultivation and also reduced the agricultural and livestock production of the villagers in the region. In the field of infrastructure (Table 10), the results showed that the construction of Daryan dam has been able to improve rural roads but has reduced the quality of rural housing in terms of materials used and also the villages landscape.

Table 7: Satisfaction with the construction of the dam from the perspective of villagers and key informants in rural communities

Satisfaction with the construction of Daryan dam	5-point Likert scale				
	VL%	L%	M%	H%	VH%
Villagers	36.0	30.4	26.7	6.9	0.0
Key informants	55.6	22.2	22.2	0.0	0.0

VL – very low; L – low; M – medium; H – high; VH – very high.

Table 8: Investigating changes in social dimensions from the perspective of villagers

Village name	Impact in social dimensions							
	Cooperation	Trust	Quarrel	Participation	Conflict	Prefer	Spatial belonging	VP
Daryan	↑	-	-	↑	-	↑	↑	V
Daryan	↑	↑	↓	↑	↓	↑	↑	K
Hajij	↑	↑	↓	↑	↓	↑	↑	V
Hajij	↑	↑	↓	↑	↓	-	-	K
Zhiwar	-	-	-	-	-	↑	↑	V
Zhiwar	-	-	-	-	-	-	-	K
Bolbar	↑	↑	↓	↑	↓	↑	-	V
Bolbar	↑	↑	↓	↑	↓	↑	-	K
Selen	↑	↑	↓	↑	↓	↑	↓	V
Selen	↑	↑	↓	↑	↑	↑	↑	K
Novin	↑	↑	↓	↑	↓	-	↑	V
Novin	↑	↑	↓	↑	↓	↑	-	K
Naw	↑	↑	↓	↑	↓	↑	↑	V
Naw	↑	↑		↑	↓	↑	↑	K
Kalji	↑	↑	↓	↑	↑	↑	↑	V
Kalji	↑	↑	↓	↑	↑	↑	↑	K
Ravar	↑	↑	↓	↑	↓	↑	↑	V
Ravar	↑	-	-	↑	-	-	↑	K
Zom	-	-	-	-	-	↑	↑	V
Zom	-	-	↓	-	↓	-	-	K
Total	16↑	14↑	14↓	16↑	9↓	15↑	12↑	

↑ => reduce impact; - => no impact; ↓ => increase impact; there was no impact on item “cultural belonging” for any village; VP – viewpoint; V and K – villagers and key informants.

Table 9: Investigating changes in economic dimensions from the perspective of villagers

Village Name	Impact in economic dimensions					Viewpoint
	Production of crops	Area cultivation	Handicrafts products	Livestock products	Access to pastures	
Daryan	↑	↑	-	↑	-	Villagers
Daryan	↑	↑	-	↑	↑	Key informants
Hajij	↑	↑	-	↑	↑	Villagers
Hajij	↑	↑	↑	↑	↑	Key informants
Zhiwar	↑	↑	-	↑	↑	Villagers
Zhiwar	↑	↑	-	↑	↑	Key informants
Bolbar	-	-	-	↑	↑	Villagers
Bolbar	-	-	-	↑	↑	Key informants
Selen	↑	↑	-	-	-	Villagers
Selen	↑	↑	-	-	-	Key informants
Novin	↑	↑	-	↑	↑	Villagers
Novin	↑	↑	-	↑	↑	Key informants
Naw	↑	↑	-	↑	↑	Villagers
Naw	↑	↑	-	↑	↑	Key informants

Table 9: (continued)

Village Name	Impact in economic dimensions					Viewpoint
	Production of crops	Area cultivation	Handicrafts products	Livestock products	Access to pastures	
Kalji	↓	↓	-	↓	↓	Villagers
Kalji	↓	↓	-	↓	↓	Key informants
Ravar	↓	↓	-	↓	↓	Villagers
Ravar	↓	↓	↓	↓	↓	Key informants
Zom	↓	↓	-	↓	↓	Villagers
Zom	↓	↓	-	↓	-	Key informants
Total	18↓	18↓	2↓	18↓	16↓	

↓ => reduce impact; - => no impact; ↑ => increase impact.

Table 10: Investigating changes in infrastructure dimensions from the perspective of villagers

Village Name	Impact in infrastructure dimensions							VP
	Access to rural roads	Access to educational centers	Access to medical centers	Quality of rural housing	Rural alleys	Drinking water quality	Village landscape	
Daryan	↑	-	-	↓	-	↓	↓	V
Daryan	↑	↓	-	↓	-	↓	↓	K
Hajij	↑	-	-	-	-	-	↓	V
Hajij	↑	↓	-	-	↑	-	↓	K
Zhiwar	↓	-	-	↓	-	-	↓	V
Zhiwar	↓	-	-	↓	↑	-	↓	K
Bolbar	↑	-	-	-	-	-	-	V
Bolbar	↑	-	-	-	-	↓	-	K
Selen	↑	-	-	-	-	-	↓	V
Selen	↑	-	-	↓	↑	↓	↓	K
Novin	-	-	-	↓	-	-	↓	V
Novin	↑	-	-	-	-	-	↓	V
Naw	↑	-	-	↓	-	↑	↓	K
Naw	↑	-	-	↓	-	↑	↓	V
Kalji	↑	-	-	↓	-	-	-	K
Kalji	↑	-	-	-	-	-	↓	V
Ravar	-	-	-	↓	-	-	-	K
Ravar	↑	-	-	-	-	-	-	V
Zom	-	-	-	↓	-	-	↑	K
Zom	↑	-	-	↓	-	-	↑	V
Total	↑15	2↓	-	12↓	3↑	2↓	13↓	

↓ => reduce impact; - => no impact; ↑ => increase impact; VP – viewpoint; V and K – villagers and key informants.

Paired samples t-test

Overall analyzed results summary of the parameters obtained based on the paired samples t-test has revealed that significant variation occurred in the study area after construction of the dam (Table 11).

The results of t-test also show that the effect of dam construction in both economic and social dimensions was significant from the viewpoint of villagers and key informants, and the research results show significant negative effects of dam construction on social capital, trust and social participation (Table 11). The viewpoint of villagers and key informants Daryan dam construction reduced the area under cultivation and production of the villagers of the region. However, in terms of infrastructure indicators, it has not been able to create positive and significant effects on the well-being of the villagers in the region.

Table 11: Daryan dam construction impact

Impact dimensions	Classification	Parameters	Mean	Std. Error mean	t value	Sig.2-tailed (p value)
Social	Villagers	Before dam construction	25.11	1.20	21.578	0.000
		After dam construction	21.80	2.54		
	Key informants	Before dam construction	52.13	2.57	11.165	0.000
		After dam construction	41.36	4.75		
Economic	Villagers	Before dam construction	32.20	1.05	28.125	0.000
		After dam construction	24.61	1.13		
	Key informants	Before dam construction	55.20	2.41	14.328	0.000
		After dam construction	38.17	3.88		
Infrastructure	Villagers	Before dam construction	24.39	1.42	5.425	0.075
		After dam construction	22.15	1.94		
	Key informants	Before dam construction	45.04	2.41	4.011	0.124
		After dam construction	47.12	2.15		

Construction of dams according to human needs is considered as one of the most likely options for contemporary human beings to meet their needs. As with any development strategy, if the necessary care is not taken, especially in the social and environmental dimensions, in the design and construction of these structures, we can see the negative effects of such approaches on the development of human societies. In the construction of dams, according to spatial, temporal and human conditions, negative and positive effects can be observed in economic, social, infrastructure and environmental dimensions.

In order to properly classify these structures, some researchers have divided the dams into two categories of small and large structures and describe the effects of creating large dams in rural areas as very destructive (Hwang et al., 2007; Tilt et al., 2009; Strobl and Strobl, 2011; Kirchherr and Charles, 2016; Tilt and Gerkey, 2016).While it is generally agreed that the construction of small dams with regard to sustainable conditions can pave the way for sustainable development of rural areas and the agricultural sector in the world (Ashraf et al., 2007; Tullos, 2009; Afshari and Ebrahimi, 2021).

Daryan dam in Iran is also an example of the construction of large water structures in the region. In the present study, 10 villages upstream of the dam were selected as the study center to study the effects of the dam from the perspective of villagers and key informants.

The results showed that, from their point of view of villagers and key informants the barrier has created a wide range of negative social and economic effects, so that the reduction of social capital of rural people, especially in components such as: cooperation, participation, solidarity, trust, conflict, etc., was evident. Also, by reducing the area under cultivation and reducing the agricultural and livestock production of the region, it has not been able

to create a suitable economic prosperity for the residents of the rural areas upstream of the dam.

By quantified the qualitative variables, it can be said that the construction of Daryan dam in the region, in the social dimension, reduced the components of social capital by nearly 20%, in the economic dimension, reduced the economic components by nearly 24%, and in the infrastructure dimension, increased the infrastructure of rural areas by only 4% has improved (Tables 8-10).

In general, it can be noted that the results showed that the residents of rural areas were dissatisfied with the construction of the dam, and this dissatisfaction is mostly due to the flooding of their fields, gardens and pastures, as well as the destruction of water sources such as: Bell spring and other springs in the region.

Also, due to the flooding of nearly 250 hectares of farms and gardens of the people of the region and also nearly a thousand hectares of pastures, lack of attention to the development of non-farm jobs and especially the creation of fish farming infrastructure and tourism development, migration of active and young people. The region has created negative effects on the economic and social dimensions of the research area.

Conclusions

The results of the research showed that the construction of the dam as one of the development projects in different countries was already done and is still being done. In developing countries such as Iran, especially if they are facing a shortage of water resources, try to manage and program the water resources that flow out of the river, especially border rivers, by dams construction.

The construction of Daryan Dam has been one of these projects in Iran, which is trying to manage the water of Sirvan River in Iran. The results of research showed that the villagers of the region are not satisfied with the construction of the Daryan Dam.

Although the construction of the dam has to some extent contributed to the development of road access and transportation infrastructure in the region, but it has not increased production and economic prosperity, income and employment in this region. In addition, the components of social capital of the people of the region have been reduced, especially their social cohesion, trust and participation.

The present study suggests that in carrying out dam construction projects, the opinions and views of local people, especially the stakeholders of the region, should be used before implementation of dam construction projects. Also, the views of local people should be considered in implementation in accordance with the needs and desires of local people in implementation of dam construction projects.

Relocation of rural settlements (villages) is one of the most important issues that most dam construction projects face. In these cases, it is necessary that, the protection of the cultural and natural heritage of the region should also be emphasized along with the infrastructural, social and economic development of the projects.

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