ISSN (Print) : 0974-6846
ISSN (Online) : 0974-5645
Indian Journal of Science and Technology, *Vol 8(S3), 28-32, February 2015* DOI: 10.17485/ijst/2015/v8iS3/72373

The Role of Water Supply Management in Rural Economy with an Emphasis on Earth Dams Construction (Case Study: Bakhazr County)

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Abstract

Since long ago, qanāts and springs have been the main water resources in the foothills rural areas and heights margin of Iran. These water supplies are mostly fed by the underground waters of top and shallow layer. Regarding the continuous droughts during the recent years, the Debi of these water resources has been severely reduced. To feed qanāts and springs in watershed management, one of the practical strategies is to construct earth dams. This is aimed to feed qanāts through the penetration of runoffs and floods in watercourses. In some villages of Bakhazr County, Khorasan-e Razavi Province, earth dams have been constructed to feed qanāts and springs since 65 years ago. The main objective of this study is to see how these earth dams affect rural development including villagers' satisfaction and the reduction of their migration motivation. Objective-wise, this study is an applied research. Yet, in nature and method, it is a descriptive-analytical research. This is carried out using document (library) research and filling out questionnaire (survey). Results show that constructing earth dam increases villagers' income and employment.

Keywords: Bakhazr County, Earth Dam, Rural Development, Water Supply Management

1. Introduction

The scarcity of water resources in rural areas for human, cattle, and farming has been severely increased regarding continuous droughts in Iran. It has brought about economic problems for rural society. A major part of farms and gardens used water resources like spring, qanāt, and seasonal rivers before. But, now, the shortage is to the extent that they have been abandoned and no longer can be cultivated by irrigation.

Fresh water is among the critical resources for human being. All of his social, economic, and environmental activities are related to fresh water. The presence of water is the necessity for living on our planet. It is the factor of creating and (or) limiting any social development and technology, welfare and misery, cooperation and (or) conflict[13].

In dry areas (like a great part of Iran), human has always faced with water shortage. Collecting water is among effective actions; especially, in proper exploitation of waters existing in dry areas[8].

Based on a UN forecast, Iran will be among those countries with chronic lack of water in 2025[10].

Various studies have been carried out regarding water supply management and rural development as well as issues concerned with feeding qanāts. Some will be implied.

In a study as "the effect of Loverfin earth dam on the quantity of underground waters", it was concluded that maintaining and exploiting ground waters in dry

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areas are possible using various methods such as aquifer management, constructing dams and …. Definitely, it affects the quantity and quality of underground water resources. It is also useful in the sustainable development of underground water resources of the area under study[2].

In a study as "the analysis of underground water management and assessment in agriculture sector with respect to water resources sustainability", Suleimani and Buzajomehri concluded that there is a significant correlation between underground water resources and the development of the area under cultivation in Sarayan region[12].

In a study as "short earth dams are good substitutes for large dams to protect watershed basins ecosystem", Ghermezcheshmeh[4] concluded that short earth dams in mountainous areas - beside preventing from flood destruction – reserve water in precipitation periods and lead to the optimal use of reserved water during arable period. This design led to the prosperity in agriculture (especially, the second cultivation) and farmers' satisfaction[4].

In their article as "water crisis and its role in Iran's sustainable development", Biglari and Hajikarimi concluded that water undertakes a vital role in sustainable development, individuals' food security and health[1].

In an article as "water crisis in the countries of Persian Gulf geopolitical area", Goli and Mahkuoei in 2013 concluded that if the present water consumption trend continues till 2050, 66 countries with about two third of total earth population will face water crisis[5].

In a study as "water resources management and fighting against drought in agriculture", Mardani Baldaji[10] considers the maintenance of water resources sustainability as the levers of water resources management system. He considers the inability of developing countries regarding the drought and lack of water in agriculture as lack of intelligent management. For him, damages from the lack of intelligence overweigh the damages from water tensions and droughts[10].

Topography, climate diversity, precipitation system distribution, physiographic structure, ground slope, and finally geographical status have led Iran to be classified among dry countries. Hence, water is among the constraining factors in the development of this country. If overlooked, the development of Iran will encounter serious obstacles and bottlenecks in near future[11].

Artificial feeding includes the entrance of water into a permeable feature aiming to feed underground water table and to reuse it with a different regime and quality via establishing extra installation or making changes in the natural condition of area[9].

Artificial feeding is one of the practical ways to increase qanāts water. The execution of short earth dams on the upstream of qanāts is among appropriate feeding methods. It is possible to collect rain water by constructing earth dams in areas with high precipitation and also in mountainous areas. Then, this water can be gradually entered into underground water tables and as a result water resources can be improved[6].

There are fifty thousands qanāts in Iran. Among them, 37000 work with about 15bilion m^3 annual exploitation[14].

Runoff from showers in a watershed basin is a potential resource of water. If properly managed, it can be applied to feed and increase qanāts water[3].

To reduce the destructive effects and control flood and also to reduce the penetration and effects of water shortage, the construction of short earth feeding dams on susceptible watercourses and on the upstream of qanāts are suitable strategies for realizing sustainable development in rural areas.

2. The Area under Study

Bakhazr County is one of the newly founded counties of Khorasan-e Razavi Province. It is located in southeast of this province in northeastern Iran. Geographically, it is located between 60°°00′°45.7″°E to 60°°40′°23.7″ E and 34°°47′°22.1″°N to 35°°19′°31.3″°N. villages with earth dams constructed between 1991 and 2006 to feed qanāts include Kordian, Arkhoud, Arzaneh, Fariabad, Chahartagh, Estejroud, Tengelmazar, Gorazi, Abineh, and Kouhsefid.

3. Material and Method

Objective-wise, this study is an applied research. Yet, in nature and method, it is a descriptive-analytical research. This is carried out using document (library) research and filling out questionnaire (survey) as well as dependent-independent variables correlation. Household is the study unit of field research. Here, dependent variable includes the reduction of rural development. Independent variable includes earth dam. To accomplish the objectives of the study, a questionnaire was developed by 18 questions based on research hypotheses. The sample of the study

consisted of the heads of households lived in 11 villages with feeding earth dams. Total sample included 3848 households. In the next step, 350 respondents were selected by simple random method using weighed classification.

4. Result

Respondents included 96% men and 4% women with 75% over 30 years old. 84% household heads were literate. 95% respondents were farmer among whom 71% had over 10 years of farming experience. 62% of these farmers earned over 60% of their income by farming.

Data from the questions of 350 questionnaires were analyzed using Likert scale. The percentage of responses with much and so much effects is as follow:

5. Hypothesis Testing

Researcher used single-group t-test for hypothesis testing. Here, observed mean was set by mean scores calculated and default score was set by total scores of the medium option.

5-1- H1: Constructing earth dams has increased villagers' income.

In this study, H1 was tested by questions 1 to 8. Respondents cited their opinions about the effect of earth dam construction on the increase of villagers' income.

Table 2. Frequency and frequency percent of responses to questions regarding H1

frequency(%)	frequency	response
7.32	205	little
15.36	430	a little
16.6	465	medium
30.79	862	much
29.33	838	so much
100	**2800**	**total**

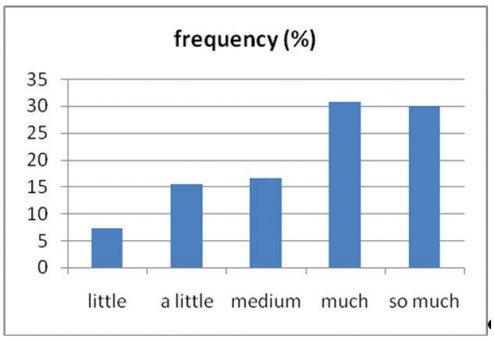

Figure 1. The frequency percent of responses to questions regarding H1.

As seen in Table 2, 205 (7.32%) responded little, 430 (15.36%) a little, 465 (16.60%) medium, 862 (30.79%) much, and 838 (29.93%) so much.

Based on research hypotheses, this study includes two states: 24 ≤ 1 H0=μ and 24 1 1>H1=μ. Since the

Table 1. The percentage of responses to each question with much and so much effects

1. How much is earth dam effective in increasing qanāt water?
2. How much is earth dam effective in increasing agriculture production?
3. How much is earth dam effective in increasing income?
4. To what extent, you think, does the earth dam contribute to floods control in the zone?
5. To what extent, you think, does the earth dam reduce damages from floods in the zone?
6. How much of your income is due to the construction of earth dam?
7. How much, you think, is the construction of earth dam necessary for villages?
8. In your opinion, how much is the construction of earth dam effective in reducing drought consequences?
9. How much is the construction of earth dam effective in enhancing the area under cultivation, in your village?
10. In your opinion, how much is earth dam effective in maintaining farmers' job?
11. How much is the earth dam effective in employment in the village?
12. In your opinion, how much is the construction of earth dam effective in economic prosperity?
13. How much is irrigation farming increased after the construction of earth dam?
14. How much is the construction of earth dam effective in improving animal husbandry condition?

calculated mean is larger (27.270) than the default mean of the questionnaire (24) and also since P-value calculated in single-group t-test is smaller than α P-value (0.05), H0 is rejected. That is, the construction of earth dam increases villagers' income. And (or), on the other hand, mean difference calculated is significant. Hence, H1 is also approved.

Table 3. Statistics related to single-group t-test

confidence interval difference		mean difference	mean	Sig	df	T	
max	min						
4.038	503.2	270.3	270.27	0	349	38.8	income increase

6-2- H2: The construction of earth dams has led to employment.

H2 was tested by 9 to 14 questions. Respondents answered these questions regarding the effect of earth dams' construction on employment.

Table 4. Frequency and frequency percent of responses to questions regarding H2

frequency(%)	frequency	response
6.14	129	little
16.86	354	a little
24.05	505	medium
29.3	628	much
23.05	484	so much
100	**2100**	**total**

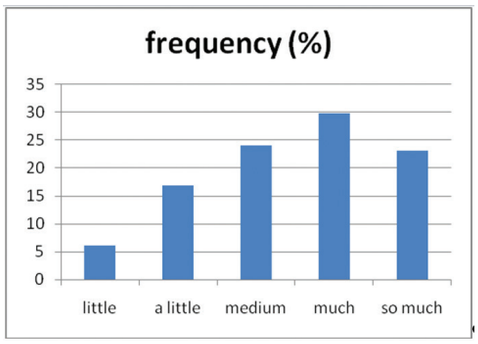

Figure 2. The frequency percent of responses to questions regarding H2.

As seen in Table 4, 129 (6.14%) responded little, 354 (16.86%) a little, 505 (24.05%) medium, 628 (29.90%) much, and 484 (23.05%) so much. Accordingly, H2 includes two states: 18 ≤ 1 H0=μ and 18 1 1>H1=μ.

Since the calculated mean is larger (20.069) than the default mean of the questionnaire (18) and also since P-value calculated in single-group t-test is smaller than α P-value (0.05), H0 is rejected. That is, the construction of earth dam leads to employment. And (or), on the other hand, mean difference calculated is significant. Hence, H2 is also approved.

Table 5. Statistics related to single-group t-test

confidence interval difference		mean difference	mean	Sig	df	T	
max	min						
2.752	1.387	2.069	20.069	0	349	5.967	employment

6. Conclusion

Results indicate that the effects of earth dam on the upstream of qanāts have led to the increase of qanāt water, and agriculture production and income. They have also controlled regional floods and reduced damages from these floods. The construction of the earth dams have decreased the adverse effects of drought and brought about improved employment and economic prosperity. Based on results, constructing earth dams on the upstream of qanāts can be one of the strategies of rural development with an emphasis on sustainability in areas where qanāt is used as water supply for agriculture.

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