International Journal of Psychosocial Rehabilitation, Vol. 25, Issue 01, 2021
ISSN: 1475-7192

Effectiveness of Watershed Management Systems on Agricultural Practices in Tehran Province's Hableroud Basin

Habibollah Mahdavivafa, Rahman Sharifi*

Abstract--- *Evaluating the effectiveness of watershed management systems is considered as a scientific criterion for their valuation. This study has been conducted to identify the impacts of stabilizing the administration of watershed systems in Tehran province's Hableroud basin (including eight pilot study villages within Damavand and Firuzkouh towns). The study has been conducted using a document-based and survey method by completing the questionnaire. The sample for this study consists of the families living in the above-mentioned villages, whose houses are located in the Hableroud basin. A questionnaire has been used to gather data from study participants, which has been completed in person after confirming its reliability and validity. The results from extracting questionnaire data and information regarding the effectiveness of watershed management system administration have been analyzed both descriptively by considering demographic information such as age, education, job (farmer, rancher, farmer-gardener, farmer-rancher, and freelancer) and inferentially using SPSS software and dependent variables including economic and environmental indices which have been all assessed through six items. The results illustrate that the mean for environmental and economic impacts of Hableroud basin's watershed management systems in Tehran province are 3.25 and 2.67 respectively, denoting "quite high" and "quite average" success condition of the implemented watershed management systems. It can be concluded that all implemented watershed management systems are more successful in the environmental domain rather than an economic one. Besides, transforming the dry farms into the garden, recent practices for flood prevention, vegetation strengthening, and increasing public cooperation are among the most significant impacts of these systems in both environmental and economic domains.*

Keywords--- *watershed, rural benefactors, economic index, Hableroud basin, Tehran province.*

I. INTRODUCTION

Watershed management practices in Hableroud basin, including Damavand and Firuzkouh towns in Tehran Province, have been initiated as "Hableroud's Soil and Water Resources Management Plan". The main objectives of this plan are decreasing the damages incurred by flood, improvement of vegetation, enhancement of life quality among rural benefactors, cooperation between people, and creating employment opportunities. Various biological and mechanical operations have been implemented in these two basins. Considering the literature in this filed in national and international level, Parabhakar et al. (2010) found that increased literacy and a higher rate of registration in school, lower migration rate, women's role enhancement, improvement of surface waters, increasing the variety in crops, controlling soil erosion, and finally improvement of agricultural technologies are among the most significant consequences of watershed management plans [1]. In another study, entitled as "An investigation on economic and social impacts of integrated

Habibollah Mahdavivafa, Rahman Sharifi, Agricultural Research and Instruction and Natural Resources Center of Tehran Province, Agricultural Research, Education and Extension Organization (AREEO).*
*Email: hmahdavi2000@gmail.com; *Email: R.sharifi1346@gmail.com*

watershed management in Shika basin in Ethiopia", and by using questionnaire and data analysis methods, Mariam et al. (2015) found that the integrated watershed management system has been successful in improving social and economic indices in Shika basin, such that it resulted in a %31 increase in family income, higher agricultural lands, improvement of the irrigation system, and increase in crops [2]. Guangyu et al. (2016) in a study entitled "Integrated watershed management: investigation, development, and emergent processes" illustrated that cooperative watershed management concerns the organization of the use of land, water, and other natural resources in a basin to provide quality services. It has an impact on both soil and land resources and includes mutual social, economic, and biophysical relations between soil, water, and land use and the relationship between high and low regions. It's noteworthy that such relations are significant [3]. In a study entitled as "Successful management of a basin: A case study of Wu Hua city, Guangdong province in China", Devi (2017) found that small basins (an area of 40-50 km) have been very prevalent in Comprehensive Water management System in Wu Hua, located in Guangdong province of China. At present, this city has 62 small basins that are managed by the comprehensive management system. Planning and selection of these systems have been undertaken by an interdisciplinary team of technicians, non-governmental organizations (NGOs), rural leaders, and farmers. According to such a system, the local government and farmers will benefit from financial support. Public cooperation in the land management domain is undertaken through various contracting models such as family contracting systems, communal and group contracting systems, and leasing systems. Because of these public cooperation systems, land, and soil protection plans in China have been successful in China. The existence of such systems resulted in outstanding improvement in the rural economy and welfare level among farmers living in Wu Hua City [4]. Madagowda et al. (2018) have investigated the living, economic and social status of Licha Putragati basin in India and found that holding different educational programs for beneficiary community and provision of new agricultural technologies in this basin not only resulted in lower soil erosion but also increased the inhabitants' income to more than double [5]. Lopez and Restrepo (2018) conducted a study in Portkoriko and found that environmental changes in tropical regions, especially the coastal ones are considered as a significant contributor in water economy and by focusing on local and quality changes of water as well as socioeconomic indices in the basin, suggested that water quality is directly related to socioeconomic indices which can be all effective in socioeconomic living conditions of basin inhabitants [6].

In Iran, Mahdivafa et al. (2012) in their study entitled "An investigation on socioeconomic impacts of watershed practices in Tar and bar Basin in Damavand from the perspective or rural benefactors, declares that %77 of rural benefactors claimed these systems were influential in increasing their income [7]. In another study entitled as "A qualitative investigation of watershed management plans through a descriptive correlational approach (a case study of Sad Bustan basin), Moghadasi et al. (2015) suggested that the most significant consequence of implementing similar plans was adopting the local conditions of the plans and solving the flood dilemma from benefactors' perspective and they also declared that it didn’t impact people's socioeconomic status and lowering the unemployment rate to a great extent [8]. In their study entitled as "Factorial analysis of socioeconomic impacts of biomechanical watershed practices from the viewpoint of inhabitants in Mashhad City's basin" Dadrasi Sabzevari et al. (2016), declared that implementation of watershed management projects led to higher agricultural practices, increase in underground aqueduct water extraction, increase in pastureland area, and prevention of flood and improving its relevant damages on lands, alluvium feeding, the water level in aqueducts and higher agricultural lands. Further, the protective actions taken in pastures had a positive impact on vegetation and higher area of pastures [9]. Maleki & Madadi (2018) in their study entitled as "An investigation of socioeconomic impacts of previously implemented natural resources projects from the viewpoint of benefactors (A case study of Andebil Basin in Khalkhal City)" found that the administration of such projects had a positive significant impact on the area of agricultural, gardening and dry farmlands and also contributed to a higher rate of livestock products [10]. In

their study entitled "An investigation on socioeconomic and environmental impacts of watershed management plans in Sepidroud basin", Ja'fari & Barati (2018) suggest that the implementation of such projects had a significant impact on controlling flood and increasing the agricultural lands. In their study, %92 of the participants agreed that this plan brought about many positive benefits for the farmers [11].

A review on the related literature suggests that watershed management practices have been proved to be effective on socioeconomic indices of local communities; such that not only improved crops but also resulted in higher employment opportunities, increased social solidarity. Higher agricultural lands, higher income from agricultural activities, flood control and lowering flood-damaged, increased pasture lands, increase in aqueduct water level, increase in underground water level, lower migration rate, and finally higher cooperation rate from the public in watershed management plans. To put it short, it paved the way for more economic development and direct/indirect public employment, improving the living of local people, and higher stability of agricultural production.

II. MATERIALS AND METHODS

Geographical Location

Hableroud Basin, Tehran Province, Iran: Hableroud basin is a total of 1265977 hectares. Its geographical coordinates are [39,51-53] Eastern length and [26-34, 35-57] northern length, between Tehran and Semnan Provinces. This basin can be divided into northern and southern parts according to its geological properties, topographical situation, natural and environmental properties, and different sociological backgrounds of its inhabitants and most importantly different strategies taken. The literature didn't suggest any scholarly evidence for the hydrological division of the site; thus, this basin will be divided based on non-natural factors, i.e. the road connecting Tehran and Semnan. The northern area has been called "Sarab Hableroud" and the southern area has been called "Payab Hableroud" (figure No.1).

Sarab Hableroud basin is 610742 hectares as a whole and is located in the northern part of the basin. This area is confined to the Caspian Sea from the North to the Semnan River basin from the East to Garmsar road from the south and Jarjroud River's basin from the west. Based on national political division, this area includes parts of Semnan and Tehran provinces and the cities involved are Firuzkouh, Absard, and Kilan. This area is considered part of the Central Desert basin and Hableroud River is its main venue.

Hableroud basin is a total of 1260000 hectares. The geographical coordinates of this basin are [39, 51-08, 53] eastern length and [26, 34-57, 35] northern width between Tehran and Semnan provinces. This basin can be divided into two northern and southern parts based on its geological, topographical, natural, environmental, and sociological differences of its inhabitants. The climate is also a cold one. The land division has been done based on non-natural features, i.e. Tehran-Semnan road. The northern area has been called as "Sarab Hableroud" and is 610000 hectares as a whole. This area is confined to the Caspian Sea from the north to the Semnan River basin from the East to Garmsar road from the south and Jarjroud River's basin from the west. According to national political divisions, this basin includes parts of the Semnan and Tehran provinces. The central cities involved in this basin are Firuzkouh, Absard, and Kilan. This area is considered part of the Central Desert's basin and its main venue is Hableroud River. "Payab Hableroud" is the southern part and is 560000 hectares as a whole (Ministry of Agriculture, Watershed Management Department, 2013). From a national political point of view, this basin is mainly located in Semnan province (Figure 2).

In this study, eight villages in Tehran Province, in two sub-areas of Delichai and Namroud in Damavand and Firuzkouh cities including Hesarbon, Aru, Havir, Dehnar, Lezor, Najafdar, Vazna, and Zarman have been selected. The total watershed management area in these villages is higher than 5000 hectares.

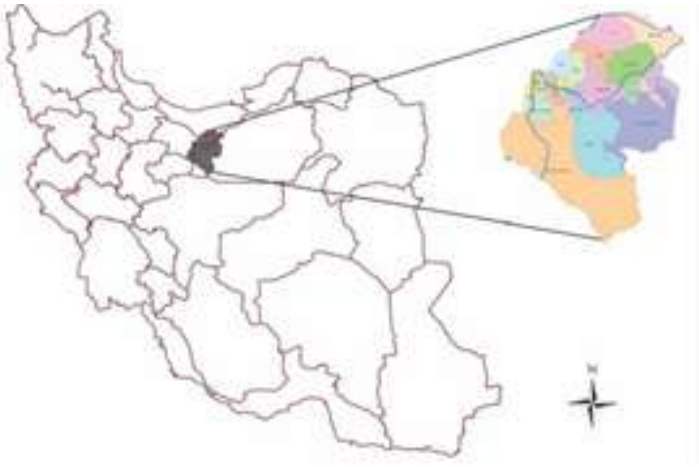

Figure 1: the location of Hableroud basin in the country and Tehran province (Source: Ministry of Agriculture, Department of Watershed Management, 2013 [12])

Figure 2: location of Hableroud basin in Tehran and Semnan Provinces (Source: Ministry of Agriculture, Department of Watershed Management, 2013 [12])

Demographic Characteristics of Pilot Study Villages

The population for implementation of Hableroud's National Plan includes eight villages within Tehran province. These villages include the ones in two sub-areas of Delichai and Namroud, in Firuzkouh and Damavand cities including Hesarbon, Aru, Havir, Dehnar, Lezor, Najafdor, Vezna, and Zarman. The total population of these villages was 5465 [13], 5182 [14], and 3852 [15] in 1996, 2006, and 2016 respectively [15] (Table 1). It's noteworthy that due to this area's particular climate, i.e. the icy weather for five months a year, especially in Firuzkouh region, the population is significantly decreased in specific seasons of the year and the highest population is concentrated in Savadkouh city. This issue as well as the existence of social relations with Mazandaran province has made the population of this region become variable and made the population growth surpass the normal rate in some urban areas, especially Tehran.

Table 1: demographic variations of selected villages in 1996-2016

No.	Village	1996	2006	2016	Number of families in 1996	Number of families in 2006	Number of families in 2016
1	Aru	1150	1057	841	255	304	344
2	Dehnar	95	59	272	22	25	65
3	Havir	20	190	303	5	61	74
4	Hesarbon	1250	948	1756	277	284	439
5	Lezur	2100	2160	965	468	521	314
6	Najafdor	280	211	420	62	66	102
7	Zarman	240	200	134	51	51	32
	Total	5565	5182	4889	1239	1137	1421

Source: Management and Planning Organization, 1996 [13], 2006 [14], and 2016 [15]

Method

This study has been conducted using document-based and survey methods. The survey method has been used to investigate features, manner of distribution, and the relationship between research variables. The technique used to collect data was a questionnaire which has been provided to families in person. After filling in the questionnaire, the data have been transferred to SPSS software and have been analyzed inferentially using a variety of tests. The population for this study includes the Hableroud basin located in Firuzkouh city, Tehran province. This basin was the location of the Hableroud Watershed Management Project. To determine the sampling volume, the central limit method has been used.

Effective indices in enhancing agricultural practices:

- Lower rate of soil erosion and destruction
- Prevention of flood
- Revitalization and prevention of pastureland destruction
- Strengthening the vegetation
- Higher water levels in springs and wells
- Lower water loss
- Higher rate of agricultural crop production
- An increasing trend toward transforming dry farms to gardens
- Higher agricultural income
- Higher employment opportunities
- Increased agricultural lands
- Increased production of livestock hay

In setting the sample number based on the central limit method, samples higher than 30 are acceptable (Sarabi, 1994) [16]. In this study, considering the scatteredness of the selected villages, about three times the acceptable sample, i.e. 88 questionnaires have been distributed among villagers (in Aru, Dehnar, and Havir in Damavand, Hesarbon, Lezur, Zarman, Vazna, and Najafdor in Firouzkouh). Then, the data from the questionnaire have been analyzed concerning the effectiveness of watershed management projects on agricultural practices in the Hableroud basin, in Tehran province.

After completing the questionnaires, descriptive and inferential statistics have been used to analyze the questionnaire data. Because the watershed management projects implemented in this area were directed at controlling erosion,

decreasing water loss, optimizing soil and aqueous resources, increasing agricultural and livestock production, increasing inhabitants' income and decreasing the damages incurred by soil erosion, and floods, etc. therefore, analysis is based on benefactors' opinion in the form of a questionnaire to increase agricultural and livestock production, lowering migration, increasing employment opportunities, increasing income, etc. have been made possible through the use of frequency percentiles.

To conduct appropriate analysis proportionate to research variables, descriptive statistics (frequency, percentage, mean, SD, scattering percentage, maximum and minimum) as well as inferential statistics (Spearman's correlation coefficient and Friedman test), have been used. Furthermore, SPSS software has been used to analyze the data. Friedman test is a non-parametric test that is somehow equal to one-way ANOVA in parametric tests.

III. DISCUSSION

Descriptive Statistics

In analyzing the impacts of watershed management projects in inhabitants' employment and increasing their income, it has been revealed that %53 of the respondents believed that the initiatives taken have been influential in forage production; however, according to the respondents, these initiatives didn't impact other economic indices and didn't affect agricultural crop production and income to a great extent (Table 2).

Table 2: analysis of the impacts of project implementation in heightening income and increasing employment opportunities

Variable	Increased	The same	Decreased
Income status	%34	%63	%4
Agricultural production	%36	%60	%4
Dry farm production	%33	%64	%
Garden crops production	%33	%60	%7
Forage production performance	%53	%43	%4
Employment status	%7	%83	%11

Besides, analysis of the impacts of watershed management projects on flood control within this basin illustrates that %71 of the study respondents believed that the flood damages have been decreased after project implementation, while %29 others believed that they didn't impact flood control at all.

Table 2: analysis of the impact of projects on flood control

Number of floods after projects implementation	0	%0	%70
Damaged after projects implementation	0	%29	%71

Inferential statistics

The effectiveness of watershed management projects on agricultural practices

The effectiveness of watershed management projects implemented in the Hableroud basin in Tehran province (Tables 3,4) has been analyzed in terms of mean, standard deviation, scatteredness coefficient, and prioritization of economic and environmental impacts of watershed management projects in Hableroud basin in Tehran province. The mean economic and environmental impacts of watershed management projects in Hableroud basin are 3.2 and 2.67 respectively, denoting "quite high" and "quite average" scores of watershed management projects in economic and

environmental domains. This illustrates that watershed management projects have been more influential in the environmental domain rather than an economic one. Besides, transforming the dry farms into gardens and the prevention of floods have been mentioned as the most significant impacts of these projects on agricultural practices.

Table 3: analysis of economic impacts of watershed management projects in Hableroud basin in Tehran province

No.	Items	Mean	SD	Scatteredness coefficient	Priority
1	Higher agricultural crops production	4.04	1.11	0.292	1
2	transforming the dry farms into gardens	3.45	0.93	0.269	2
3	Increasing agricultural income	2.84	1.21	0.299	3
4	Increasing employment opportunities	2.62	0.92	0.232	4
5	Increasing farm areas	2.07	1.12	0.517	5
6	Increasing livestock forage production	1.65	1.45	0.541	6
	Total	2.76	1.12		

Table 4 displays the effectiveness of watershed management projects in the Hableroud basin in Tehran province concerning statistics such as mean, standard deviation, scatteredness coefficient, and prioritization of environmental impacts. The mean environmental impacts of watershed management projects in the Hableroud basin are 3.25 which denotes the "quite high" status of previously implemented watershed management projects in the environmental domain. This result shows that the projects have been successful in the environmental dimension.

Table 4: environmental impacts of watershed management projects in Hableroud basin in Tehran province

No.	Items	Mean	SD	Scatteredness coefficient	Priority
1	Decreasing soil damage and erosion	3.95	1.01	0.255	1
2	Prevention of flood	3.86	.99	0.256	2
3	Revitalization and prevention of pastureland destruction	3.60	1.14	0.316	3
4	Strengthening vegetation	3.26	1.42	0.435	4
5	The fullness of wells and springs	3.30	1.47	0.445	5
6	Decreasing the current waters	3.18	1.47	0.462	6
	Total	3.52	1.25	0.435	-

IV. CONCLUSION

The data collected from study participants showed that %71 of them believed that damages incurred by the flood have been decreased after watershed management projects implementation and %29 of them believed that these initiatives have been ineffective in lowering flood damages. The effectiveness of watershed management projects implemented in the Hableroud basin in Tehran province is included in Table 4 (including mean, standard deviation, scatteredness coefficient, and prioritization of environmental impacts of watershed management projects in Hableroud basin. The mean economic impacts of watershed management projects in the Hableroud basin in Tehran province are 2.67 which denotes the "quite high" status of such projects in the economic domain. Besides, the mean environmental impacts of watershed management projects in the Hableroud basin are 3.25 which denotes "quite high" status of watershed management projects success in the environmental domain. This illustrates that watershed management projects have been more successful in the environmental domain rather than an economic one. Besides, transforming the dry farms to gardens and the prevention of floods have been mentioned as the most significant impacts of such projects in the agricultural field.

Concerning environmental impacts, it can be argued that the environmental impacts indices of watershed management projects in Hableroud basin are prioritized as lowering soil destruction and erosion, prevention of flood, revitalization, and prevention of pastureland destruction, strengthening vegetation, the fullness of wells and springs and decreasing the amount of unguided current water.

The questionnaire has been divided into two parts; the first part has been entitled as "positive impacts of watershed management projects on increasing the yield of crops". There were five items in this part as a whole including its impact on increasing the agricultural farms' and gardens' area, strengthening vegetation, increasing agricultural income, the yield of wells and springs, and increasing livestock forage throughout the region. All five items have been rated average and this difference has become significant at the %95 confidence interval. Therefore, the research question concerning the impact of biological and mechanical watershed management operations in increasing livestock and agricultural production both qualitatively and quantitatively is acceptable.

The second part of the questionnaire concerns the positive impact of watershed management projects on flood in this region. Two items about the number of floods after the implementation of projects and the number of damages incurred by such floods have been included here. Both items gained a higher score than the one expected on a Likert scale. This difference has been significant at %95 confidence interval. Therefore, it has been proved that implemented projects have been successful in increasing the possibility of floods.

In the present study, the positive and negative impacts of watershed management projects on different variables involved in watershed management projects including decreasing soil destruction and erosion, controlling flood, revitalization, and prevention of pasture land destruction, strengthening vegetation, the fullness of wells and springs, decreasing unguided current waters, etc. have been investigated.

That's while authors like Prabhakar et al. (2010) suggested that higher literacy and school registration rate among villagers, lower migration rate, strengthening women's role in society, improving the water level, variety in agricultural methods and crops. Controlling soil erosion and destruction and improving agricultural technologies are considered as the most significant impacts of watershed management projects [1]. Mariam et al. (2015) also found that watershed management projects have been successful in improving economic indices and led to a %31 increase in family income of the beneficiary families, increasing the agricultural lands, improvement of the irrigation system, and increasing the production of crops [2]. Madagowda et al. (2018) suggested that holding educational courses for beneficiary communities and the provision of new agricultural technologies led to higher income (double) for the inhabitants, lower soil erosion, and increased crop production [5]. Furthermore, Dadrasi Sabzevari et al. (2016) declared that implementation of watershed management projects has led to increased agricultural farms area, higher yield of aqueducts, increased pasture land area, prevention of flood and its associated damage to lands, and improvement of agricultural and gardening crops [9]. Ja'fari & Barati (2018) also claimed that the implementation of such projects brought about any positive impacts for farmers and thus %92 of the respondents believed that these projects were beneficial for the farmers in terms of economic advantages. Further, Maleki & Madadi (2018) found that such implemented projects not only had a positive impact on vegetation and agricultural lands but also led to higher livestock production [10].

Accordingly, it can be argued that the survival of such vital natural resources can't be guaranteed without a good understanding of socioeconomic factors and it can't establish a stable system. This project has been initiated based on the agreement between the Islamic Republic of Iran's government and the United Nation's construction plan to achieve stable management of the nation's soil and water resources. The basis of this plan has been intended to attract public cooperation, coordination between different sectors, and completion of sample operations to promote production system's effectiveness, higher income, creating employment opportunities, and maintaining and stabilizing natural resources and environment.

Considering the results obtained, it's necessary to take necessary actions to connect governmental and public benefits through corporations, communities, and NGOs in basins. It's also necessary to plan for educational and promotional programs to inform people for better protection and conservation of soil and water resources during the initiation and maintenance phases of watershed management projects.

REFERENCES

[1] Prabhakar ،K. ،Lavanya Latha ،K. & Papa Rao ،A. (2010). Watershed Programme: Impact on Socioagricultural and Socio-economic Spheres of the Farmers. Journal of Agricultural Science1 ،(1):31-37.
[2] Mariam G., Yaebiyo Yayneshet Tesfay, Dereje Assefa.(2015).Socio-Economic Impact Assessment of Integrated Watershed Management in Sheka Watershed, Ethiopia. The journal economies and sustainable development.Vol6, No9, 2015.
[3] Guangyu Wang, Shari Mang,Haisheng Cai, Shirong Liu, Zhiqiang Zhang, Liguo Wang & John L. Innes, (2016). Integrated watershed management: evolution, development and emerging trends,Journal of Forestry Research volume 27, pages967–994(2016).
[4] Deyi , Wu,.2017 successful watershed management in A case study of Wuhua County, Guangdong Province, China Published in The status of Watershed Management in Asia WMTUH/FARM Field Doc1, pp 7-18
[5] Madagowda Madhu, Niik B.S. Adahikary partha pratim.(2018). Livelihood and socio-economic development through watershed management-An impact assessment of Lachhaputraghati tribal catchment. The International Journal of Earth & Environmental Sciences, Volume 3,Issue 1,2018.
[6] López ,Johanna Colón & Restrepo Carla .(2019).Water Quality and Socio-Economic Indicators are Linked in a Tropical Watershed: Emerging Implications for the Sustainable Management of Waterscapes .Wetlands ,volume 39, pages 1303–1316(2019).
[7] Mahdavivafa, Habibollah, (2012). Socio-economic evaluation of watershed management activities carried out in Damavand wetland basins from the perspective of villagers, Agricultural and Natural Resources Research Center of Tehran Province.
[8] Moghadasi Nafise ,Vahedbordi Sheykh ,Najafinezhad (2015) Qualitative Evaluation of Watershed Management Projects by Descriptive Correlation Method (Case Study: Bustan Dam Watershed), Scientific Journal of Soil and Water Conservation Research, Volume 22, Number 2, August and September 2015, pp. 205-218 .
[9] Dadraei sabzevari Abolghasem,Gazanchyan Ali ,Namaki Mohamad (2015). Factor Analysis of Socio-Economic Impacts of Watershed Management Biomechanical Activities from the Perspective of Watershed Residents of Gosh Watershed in Mashhad, Journal of Watershed Engineering and Management Volume 8, Number 4, Fall 2016, pp. 302-209.
[10] Maleki, Mohsen, Mamdadi, Elmira (2018). Assessing the socio-economic effects of natural resource projects implemented from the perspective of stakeholders (Case study: Andbil watershed - Khalkhal county) Rangeland Magazine, Year 12, Issue 3, Fall 2018, pp. 280-267.
[11] Jafari Gholam Hossein and Barati Zeinab (2018). Under the title of Assessment of Socio-Economic and Environmental Impacts of Watershed Management Plans of Speedroud Watershed, Journal of Geography and Urban-Regional Planning, Spring 8, 2016,No.26..
[12] Deputy of Watershed Management of the Ministry of Jihad Agriculture (2013). Sustainable management plan of water and soil resources of Hablehroud, first phase.
[13] Management and Planning Organization, Statistics Center of Iran. (1996) General population and housing census.
[14] Management and Planning Organization, Statistics Center of Iran (2006). General population and housing census.
[15] Management and Planning Organization, Statistics Center of Iran (2017). General population and housing census.
[16] Sarabi, Hassan. 1994. Introduction to Sampling in Research, Samat Publications, Tehran.