International Journal of Agricultural Management and Development
Available online on: www.ijamad.iaurasht.ac.ir
ISSN: 2159-5852 (Print)
ISSN:2159-5860 (Online)

Research Paper *https://dorl.net/dor/20.1001.1.21595852.2021.11.2.10.4*

Factors Affecting Farmers' Adaptation to Climate Change: A case of wheat farmers in Gachsaran, Iran

Mohsen Mousaei [a]

Received: 03 August 2019,
Accepted: 24 May 2021

Abstract

Climate change is one of the most important challenges that affect different parts of human life on the earth. Due to its very close relationship with natural resources and climatic conditions, the agricultural sector is the most affected by this change. Thus, this study aimed to identify the factors affecting the capacity of wheat farmers to adapt their careers to climate change in Gachsaran County, Iran. The research was an applied study in which field data were used in a descriptive-correlational and causal-correlation design to analyse the relationships of the variables. The research population was composed of 1845 wheat farmers working in Gachsaran. Using Cochran's formula, 318 farmers were selected for the study through simple randomization. A questionnaire, which included personal and professional features, the factors affecting the farmers' adaptation capacity, and the farmers' perceptions of climate change, was developed by the researcher. An expert panel was used to address the validity of the developed questionnaire. Using Cronbach's alpha, the reliability of the questionnaire was measured to be at the acceptable level of 0.72. The results of the multivariate regression showed that social capital, quality of life, the number of people aging over 60 in the family, the number of family members contributing to agriculture, income from agriculture, access to educational services, age, academic degree, total agricultural land, level of experience, and wheat yield per hectare accounted for the bulk of variance in the dependent variables (39.77%).

Keywords:
Adaptive capacity, vulnerability, climate change, farmers, Gachsaran County

[a] *Assistant Professor, Department of Agricultural Management, Gachsaran Branch, Islamic Azad University, Gachsaran, Iran*

Corresponding author's email: dr.mousaei@gmail.com

INTRODUCTION

Exposure to climate change largely depends on the regional geographical situation. Communities in semi-arid areas may be exposed to droughts while coastal communities are mostly exposed to storms or severe sea storms. Adaptability is the ability of a system or family to adapt to climate change, including climate change and the elimination or reduction of potential hazards, overcoming the effects, and exploiting opportunities in their favor. Sensitivity is the degree to which a system or community is affected by tensions from climate change (Simpson, 2016).

Vulnerability is the degree to which a system is susceptible to or unable to cope with the adverse effects of climate change. Vulnerability depends on the type, magnitude, and rate of climate change and variations to which a system is exposed, its sensitivity, and its adaptive capacity. Three elements that contribute to the vulnerability of farm livelihoods include:

Livelihood vulnerability =
(exposure × sensitivity) – adaptive capacity

Adaptive capacity depends on many factors, including the farmer's awareness of the weather and climate change patterns, the willingness to cooperate, the services provided by the government, social and economic systems supporting fair access to water and land, education, information, financial services, and infrastructure (Simpson, 2016).

Adaptation or conformity to climate change has increasingly been addressed by organizations and experts as a critical response to the challenges of global climate change caused by greenhouse gas emissions (IPCC, 2007, UNFCCC, 2007).

Despite the fact that adaptation to environmental changes is not a new phenomenon. There is a special need for custodians, researchers, and civil society, especially in communities at risk of climate change, to understand compatibility and increase adaptability (Nielsen & Reenberg, 2010).

Different regions of the world differ in sensitivity, adaptability, and vulnerability to climate change. Developing countries are generally more vulnerable to the effects of global warming because they are more dependent on climate-sensitive sectors, such as livelihoods agriculture, and they do not have sufficient resources to protect themselves from changes in global warming (Barak, 2006).

Climate change can have serious environmental, social, and economic impacts on farmers' activities, especially rural farmers whose livelihoods are dependent on rain. Given the importance of the agricultural sector in the economy, this sector is affected by many factors, including natural disasters such as droughts and floods. In recent years, adaptation to climate change has become a major concern for farmers, researchers, and policymakers (Halsnaes & Traerup, 2009).

Farmers use climate change strategies to reduce the risk of climate change. For example, in Mali, farmers have made use of short-term maize varieties in the shorter seasons although varieties with longer-term growth produce higher yields and taste better (Lacy et al., 2006). Potential capacity is the capacity or potential of a system to adapt to climate changes. New innovations can play an important role in adapting to climate change (Ebi et al., 2005).

Although technical capacities are one of the main aspects of adaptive power, these technologies themselves can have an impact on climate change so that the use of new technologies can increase temperature and reduce rainfall (IPCC, 2007). Recent studies have shown that adaptability depends on social factors such as social capital and the structure of governments in addition to technological advancement and economic development (Brooks & Adger, 2005; Klein & Smith, 2003).

There are many examples showing that in addition to economic factors, social capital, interpersonal relationships, perceptions of climate change, customs, and traditions affect

the adaptation capacity of a community. For example, you can refer to Samoa communities in South Pacific. In these societies, adaptation to the damage caused by the overwhelming majority is based on family relationships. Borrowing from family members and other relatives is one of the important strategies for addressing climate change in this region (Barnett, 2001; Sutherland et al., 2005).

Farmers in developing countries need to adapt to changing climates, and this change will increase in the future. Crop operations in many areas should be changed. Farmers can also change their cultivation. For example, in warmer and drier areas of Africa, they can replace sorghum with corn, which needs less water. Another strategy that farmers can choose is to grow crops that are more resistant to heat and drought. But, before adaptations are made at the farm level, farmers need to understand that they should change the type of cultivation, operations, and cultivated cultivars (Shushtarian, 2007).

Considering the United Nation's warning about the excessive consumption of water around the world, it is seen that as a result of climate change, the drought is not only affecting Iran but also the whole world. It also warns that, in near future, about 2.5 billion people will have difficulty finding fresh water. This warning indicates that more than 31 countries will face water shortage soon, and Iran is not an exception. Investigating the estimates of average daily temperature from the year 1951 to 2011 in Iran shows a 2.5-3 degrees increase in the temperature for most meteorological stations.

The study conducted by Wheeler et.al (2013), aimed at examining farmers' beliefs about climate change and adaptation strategies in Australia using the OLS model. The study shows that the variables of belief in climate change, age, agricultural background, and water content have a negative and significant relationship with the overall strategy of adaptation to climate change. Also, the status of past adaptation, the status of native knowledge, the environmental factor, the percentage of reuse of infrastructure, and the future of hope with a general strategy for adapting to climate change have a positive and significant relationship.

In a study on choosing climate change adaptation methods by farmers in Ethiopia's Neolithic Bass, Deressa et al. (2008) concluded that the variables of literacy level, gender, age, household head's economic status, access to credit, access to information on regional climate, environmental status, and social capital were effective in selecting adaptation methods by farmers, and financial constraints and lack of awareness of adaptation methods were among the most important obstacles to adaptation to climate change by farmers.

Vincent (2007) states that the demographic structure of households is effective in their ability to adapt to climate change. The presence of the elderly over the age of 60 years and children under the age of 15, as well as disabled people, reduces adaptability to climate change. Families that are more connected to the outside world and whose children live outside the village are more able to adapt to changes.

It is also reported that production, natural and physical capital, household head's educational level and gender, social capital, literacy and employment, institutions, governments, social networks, supply inputs, health, and technology are significantly correlated with the adaptive capacity (Adger, 2001; Barnett, 2001; Below et al., 2012; Campbell, et.al., 2011; Bekele & Drake, 2003; Idrisa1 et al,. 2012; Maddison, 2007; Sutherland et.al., 2005).

Moreover, (Adesina and Forson, 1995; Idrisal et al. 2012 and Maddison, 2007) have concluded that governmental or non-governmental support of individuals, farmer attributes, agricultural experience, people's social and economic status, access to credit and resources, and access to extension services increase the likelihood of farmers' adaptation to climate change.

Several studies have been conducted on the influence of compatibility options and cli-

mate change in the agricultural sector in Australia and Canada (Bryan et. al., 2009; Deressa et al., 2008; Marshall, 2010; Smith & Skinner, 2002). These authors have come to the consensus that adaptation generally includes changes in production, such as multicrop production, irrigation, cultivation time, cultivation place, irrigation infrastructure, environmental management, such as tree planting, and farm management, such as insurance use. Various studies with the same purpose have been conducted in Iran (Ghambar Ali et al., 2012; Jamshidi et al., 2015; Khalidi et al., 2015; Khosravipour et al., 2013; Pazoknejad & Salehi, 2014). The results show that the following factors are the most important ones affecting the implementation of adaptation strategies: land area, access to service centers, access to credit, second job, literacy level, household income, agricultural experience, the amount of loans received, the production cost per hectare, family members' participation in agricultural work, the level of knowledge about climate change, quality of life, the status of membership in social groups, the status of agriculture wells, natural capital, access to promotion services, soil fertility, and occupational health.

Climate change affects all regions of Iran although these effects are not the same throughout the country. Different strategies are being taken by farmers to deal with these changes. Considering the fact that a large number of farmers in this region are engaged in cultivating wheat, and since the study site is located in a hot and arid area that is deficient in rainfall and it is subject to atmospheric changes, it is necessary to examine the capacity of farmers to adapt to climate change in the region. Accordingly, the main question of this research was what the most important factors affecting the capacity of wheat farmers in Gachsaran to respond to climate change are?

METHODOLOGY

Gachsaran County is located in the southwest of Kohgiluyeh and Boyer Ahmad province (Lat. 30°15' N, Long. 50°45' E). Dogonbadan is the center of the county. The population of the city was 124096 in the 2016 census. The area of the city is 4683 km^2 located at an altitude of 720 meters above sea level. Gachsaran is located in a tropical region and has a temperate and dry climate in the northeast and a tropical climate in the southwest. The Zohreh River is the main river flowing in this city, which is in the southeast of Dongnbadan. The average precipitation amounts to 441 mm with an average air temperature of 22.2°C, which can reach 50°C in summer. Based on the statistics provided by the Agricultural Jihad Department of Gachsaran in 1996-97, 5,000 hectares of land in this county were cultivated with irrigated wheat and 7,000 hectares with rainfed wheat. These lands are located in four districts of Boyer Ahmad Tropical, Imam Zadeh Jafar, Lishtar, and Kheirabad, which constitute the statistical population of the present study. According to the report of Agricultural Jihad Organization of Gachsaran County, 22129 tons of wheat were harvested in 2019. The county has 11,000 hectares of rainfed and irrigated farms, of which more than 80 percent are irrigated farms. Annually, more than 96,000 tons of agricultural and livestock products are produced in Gachsaran County. According to the report of Agricultural Jihad Organization of Gachsaran , the damage by rain, hail, and lightning amounted to 89 billion IRR to the agricultural sector of Gachsaran County in 2019 of which the damage was 47 billion IRR in agriculture and horticulture, 22 billion IRR in water resources, and 19 billion and 400 million IRR in livestock and poultry.

The present research is applied in terms of purpose and a descriptive correlation and causal relationship in terms of field data collection and the investigation of the relationships between variables. The statistical population of the research was composed of wheat farmers, amounting to 1845 people, in Gachsaran County, Kohgiluyeh and Boyer Ahmad province. Various methods are used to determine the sample size in the research.

One of the common methods is Charles Cochran's formula. Based on this formula, the number of sample individuals for the present study was calculated to be 245. Simple random sampling was used to collect the required data. Data were collected with a researcher-made questionnaire composed of sections for individual and professional characteristics of the respondents, farmers' viewpoints on climate change, adaptation methods, and factors affecting their adaptation capacity in the study area. The validity of the questionnaire was checked by a panel of experts, and to determine its reliability, 30 questionnaires were distributed among wheat farmers in Kohgiluyeh County who had similar conditions to the studied population. Using SPSS software, Cronbach's alpha coefficient was calculated whose mean value for the different sections of the questionnaire was 0.72, confirming its reliability.

After reviewing the research literature, independent variables were identified and measured using the questionnaire. The independent variables included the factors affecting farmers' adaptive capacity to climate change (i.e., social capital, quality of life, age, education level, total land area, agricultural and non-agricultural income, amount of loans received from banks, utilization of educational-extension services in the field of climate change, wheat yield per hectare, agricultural skills, wheat production per hectare, agricultural experience, number of family members, number of members under 15 years of age, family members over 60 years old, number of patients in the family, and number of members participating in the agricultural work), and the dependent variable was the capacity of farmers to adapt to climate change.

Data were analyzed by descriptive statistics including mean, standard deviation, frequency, and frequency percent. The coefficient of variation (CV) was used to prioritize wheat farmers' views on climate change, which was calculated using the standard deviation. Inferential statistics used to calculate the correlation between the variables according to the measurement scale of the data for which Spearman's correlation coefficient was used. This test is nonparametric and is used when the measurement scale of the data is rated. The multivariable regression was also employed to predict the effect of independent variables on dependent variables. In general, there are three analytical strategies for choosing independent variables: concurrent strategy, step-by-step strategy, and hierarchical strategy. In this research, a coherent strategy was used. As such, all independent research variables were integrated into the analysis.

To measure and calculate social capital and quality of life and wheat farmers' adaptation, five questions were ranked on the Likert scale. The above variables were measured by 7, 8, and 5 questions, respectively. Then, the responses were analyzed in SPSS software. The results in Table 4 show a positive and significant relationship of the variables of social capital, quality of life, agricultural experience, education level, agricultural skills, and agricultural income with adaptability capacity to climate change. The results also show a negative and significant relationship of family size, number of members over 60 years old, number of patients in the family, the cost of wheat production per hectare, and the number of people participating in agriculture with the capacity to adapt to climate changes. There was no significant relationship between the amount of loans received, the number of people under 15 years old, and the yield of wheat per hectare with the adaptation capacity.

RESULTS

Based on the results in Table 1, 19.5 percent of the population studied were between 30 and 35 years old, and 6 percent were above 60 years old. Also, 55.2 percent of the respondents had 1-5 hectares of land, and 3.1 percent had >20 hectares of land. In terms of literacy level, 28 percent had a basic literacy level and 8.2 percent had a bachelor's degree or higher.

Table 1
Investigating the Individual Characteristics of the Beneficiaries of the Study Area

Characteristic	Frequency	Percentage	Cumulative percentage
Age (years)			
25-30	41	12.9	12.9
30-35	62	19.5	32.4
35-40	44	13.8	46.2
40-45	36	11.4	57.6
45-50	45	14.1	71.7
50-55	27	8.5	80.2
55-60	44	13.8	94.0
>60	19	6.0	100
		100	
Total land owned (ha)			
1-5	176	55.2	55.2
5-10	70	22.0	77.2
10-15	45	14.1	91.3
15-20	18	5.6	96.9
>20	10	3.1	100
		100	
level of Education			
Illiterate	89	28.0	
Elementary	67	21	
Guidance course	75	23.6	
Diploma	61	19.2	
Bachelor's degree or higher	26	8.2	

Farmers' perspectives on climate change

The results show that wheat farmers are aware of climate change, and this can sometimes have a very positive impact on increasing their adaptability to climate change. The findings show that about 90 percent of the farmers in the study area believe that floods, storms, and droughts are caused by climate change, and this is the first rank. Most farmers also believe that rainfall has decreased and temperatures have increased as compared to the past, which are the second and third ranks, respectively. Other factors, e.g., changes in climate patterns, underground water abatement, and rising droughts versus the past, are in the next ranks. The results are presented in Table 2.

Measuring farmers' adaptation capacity

Table 3 shows the capacity of farmers to adapt to climate change. According to the information presented in the Table 3, 136 respondents (42.8%) stated that their knowledge about adaptation strategies was moderate. In addition, 97 respondents (30.6%) evaluated the counseling received about adaptation with new cultivars to be high. Also, 98 respondents (30.8%) stated that their access to inputs and resources was to a large extent. Other information on farmers' adaptation is shown in Table 3.

Identification of factors affecting wheat farmers' adaptability capacity

In order to identify the factors affecting wheat farmers' adaptation capacity in Gachsaran, multiple regressions were used simultaneously. To this end, the variables related to the factors affecting the adaptability capacity were identified and extracted and the variables that had a significant relationship were included in the regression equation. The re-

Table 2
Assessing Farmers' Perspectives on Climate Change

Items	Totally disagree	Disagree	Unaware	Agree	Totally agree	Averager-ating	Standard deviation	Criterion Coefficient	Rating
Storms, floods, and droughts have increased due to climate change	15	28	167	81	27	4.12	0.774	0.187	1
Climate patterns are changing	16	36	138	98	30	4.10	0.910	0.219	4
Temperatures have not changed	104	58	66	55	35	2.37	1.32	0.556	9
Temperatures have increased	0	30	125	73	11	4.03	0.836	0.207	3
Rainfall is unpredictable	35	39	155	73	16	3.73	1.14	0.305	7
Rainfall has not changed	141	64	47	37	29	2.04	1.23	0.602	10
Rainfall has dropped	10	10	126	118	54	4.26	0.824	0.193	2
Groundwater has decreased	17	26	106	133	36	4.20	0.990	0.235	5
Groundwater has not changed	101	86	55	52	24	2.17	1.12	0.516	8
Droughts have increased versus the past.	16	18	98	146	40	4.08	1.10	0.269	6

Table 3
Farmers' Adaptability to Climate Change

Items	Very Low	Low	Moderate	Much	Too much
How much is your knowledge about adaptation strategies?	3310.4	7022	13642.8	5617.6	237.2
How much advice do you receive regarding adaptation with new and resistant cultivars?	3912.2	7924.8	9730.6	8627	175.4
How much access do you have to inputs and resources?	3611.3	6620.8	8928	9830.8	299.1
How available are new and resistant cultivars in the region?	3711.6	10834	9730.5	6821.4	82.5
How much use do you make of new and resistant cultivars?	309.4	9630.3	9529.8	8125.5	165

Table 4
Correlation of Research Variables with Adaptation Capacity of Wheat Farmers in Gachsaran County

Variables	Correlation coefficient	*p*-value
Quality of Life	0.183**	0.004
Social capital	0.245**	0.000
Age	-0.129*	0.044
Experience in agriculture	0.160*	0.012
Level of Education	0.222**	0.000
Skills in agriculture	0.140*	0.028
Family size	-0.292**	0.000
Number of members over 60 years' old	0.384**	0.000
Number of patients in the family	-0.104	0.104
The cost of wheat production per hectare	-0.241**	0.001
The amount of income from agriculture	0.190**	0.003
Non-agricultural income	0.045	0.479
Amount of loan received	0.049	0.448
Number of people participating in agriculture	0.151*	0.004
Benefit from educational and promotional services	0.186**	0.003
Cropland Land Levels	0.142*	0.026

**p<0.01 and *p<0.05

sults are presented in Table 6. The Durbin Watson Index (Variable independence index) was used to determine if the data were suitable for regression. According to the value obtained (1.62) (Table 5), the data were suitable for performing regression**.** On the other hand, to check the alignment, the tolerance coefficients (i.e., the ratio of the variance of a variable that is not explained by other independent variables) and the variance inflation factor (obtained by dividing the number one by the tolerance value) were examined. It should be noted that the lower the tolerance is, the less information is available about the variables and the more problems can be found in using regression. The variance inflation factor is also the inverse of tolerance and as it increases, the variance increases the regression coefficients and makes the regression unsuitable for prediction Tolouei Ashlaghi & Safakish, (2010). The results from Table 6 show that the standard value of tolerance for all variables included in the model was more than 0.1 and the standard value of variance inflation factor for all variables was less than 10. As a result, it was possible to use regression. In other words, the data were suitable for regression.

As shown in Table 5, the value of F is equal to 10.35, which is greater than the value of F in the Fisher Table with 315 degrees of freedom and a significant level of 5percent, so the null hypothesis is rejected and the model is significant at the 95 percent confidence level.

Standardized coefficients (Beta) were used to see which independent variable would better predict the dependent variable. The most important factors influencing the increase in adaptation capacity were found to be wheat yield per hectare, total arable land, number of people participating in agricultural activities, social capital, land area, age, use of educational and extension services, farming experience, agricultural income, quality of life, and educational level. The variable of wheat yield per hectare has the highest relationship with the adaptive capacity of farmers and is a stronger predictor of the dependent variable. Meanwhile, the educational level has the least relationship with the dependent variable (standard coefficient 0.128). As shown in Table 5, the independent

Table 5
Summary of Regression Model

Durbin Watson	S.D	Adjusted R Square	R^2	R	Model
1.62	0.412	0.645	0.388	0.622	1

Table 6
Factors Affecting Wheat Farmers' Adaptability Capacity in Gachsaran County

Independent variables	t-value	B	Beta	*p*-value	VIF	Tolerance
Social capital (x1)	2.337	0.154	0.014	0.020	1.076	0.897
Quality of life (x2)	2.131	0.121	0.128	0.034	1.129	0.799
Age (x3)	-2.011	0.148	0.008-	0.046	1.098	0.925
Experience in agriculture (x4)	2.10	0,140	0.005	0.035	1.060	0.943
Education level (x5)	2.267	0.128	0.071	0.024	1.239	0.788
Wheat yield per hectare (x6)	3.306	0.236	0,001	0.001	1.222	0.831
Number of family members (x7)	-3.275	0.227-	0.062-	0.001	1.438	0.744
Number of members over 60 years old (x8)	-5.208	0.366-	0.372-	0.000	1.032	0.822
Total agricultural land (x9)	2.394	0.201	0.021	0.018	1.129	0.966
Income from agriculture (x10)	2.089	0.132	0.001	0.038	1.111	0.921
Number of people involved in agriculture (x11)	2.937	0.173	0.123	0.004	1.030	0.890
Benefit from educational and promotional services (x12)	2.464	0.142	0.115	0.014	1.232	0.789
Cropland Land Levels (x13)	2.621	0.154	0.016	0.009	1.123	0.856
constraint	10.489		3.647	0.000		

$p<0.01$, df=315, F=10.35, R^2=39.77

variables accounted for 38.8 percent of the variability of the adaptive capacity. Based on the data in Table 5, the regression equation of the factors affecting the adaptation capacity of wheat farmers in Gachsaran County is obtained as follows:

$$Y=3.647+0.014x1-0.128x2-0.008x3+0.005x4+0.071x5+0.001x6-0.062x7-0.372x8+0.026x9+0.001x10+0.123x11+0.115x12+0.153x13$$

DISCUSSION AND CONCLUSION

In the present study, it was revealed that there was a positive and significant relationship between social capital and the adaptation capacity of wheat farmers in the studied county. Social capital is a capacity, social essence, or informal normality that promotes cooperation between individuals and institutions of a society. Social capital generally affects the strengthening of coordination and cooperation between individuals within a group and organization. Social capital also

boosts economic and human capital. The existence of social capital makes it possible to transfer information and innovations and to promote the level of community members' cooperation and reduce the costs of exchanges and communications. Therefore, attention to social capital and its strengthening in improving and increasing the capacity of farmers' adaptation to change is very influential. Several studies, including Adger (2001), Barnett (2001), Deressa et al. (2008), Khalidi et al. (2015), Sutherland et al. (2005) also show that social capital plays an important role in increasing the adaptability of individuals.

The quality of life of farmers in the studied area is one of the factors affecting their adaptation capacity. The term "quality of life" generally refers to the context in which people live, such as pollution and the quality of housing, as well as some of their traits and characteristics (such as health and education). The word "quality of life" is more related to the natural environment and the external conditions of people' life such as pollution, housing quality, aesthetic aspects, traffic congestion, crime outbreaks, and so on. These variables have a significant impact on the level of satisfaction of individuals with their lives. Therefore, the better quality of life and the more facilities the people have, the more suitable their conditions are to adapt to other factors affecting their lives (including climate change). The results of the research are confirmed by Khosravipour et al. (2013) and Vincent (2007).

Farmers' skills and experience have a positive effect on wheat plant adaptability. Regression results indicate that skill level and experience in agriculture have an impact on wheat adaptability capacity. Experience is one of the key factors in the exploitation of production factors including land and water. Other research studies have suggested that farmers are major predictors of adaptability and climate change. Experienced farmers can predict weather conditions and apply appropriate strategies to counteract them, and this has a significant role in increasing their adaptive capacity. Studies by Ghambar Ali et al. (2012), Idrisa et al. (2012), Khalidi et al. (2015), Maddison. (2007) and Wheeler et al. (2013) support the research results.

Benefiting from educational and extension services has a positive effect on wheat farmers' adaptation capacity. Education and communication with information resources will have an effective role and will influence the attitudes of migrants towards climate change. Therefore, farmers' access to extension services has a significant impact on their knowledge of climate change, and this higher awareness has an impact on improving their adaptation capacity. This result is in line with the results of Adesina and Forsson (1995), Below et al. (2012), Ghambar Ali et al. (2012), Idrisa et al. (2012), Khalidi et al. (2015), and Maddison (2007).

Educational level has a positive effect on wheat farmers' adaptation capacity in Gachsaran and is one of the parameters that determine the capacity to adapt to climate change. Studies by Bekele and Drake (2003), Below et al. (2012), Campbell et al. (2011), Derssa et al. (2008), Jamshidi et al. (2015), and Khalidi et al. (2015), also confirm this conclusion.

Higher educational levels increase the awareness of wheat farmers about environmental changes, enabling them to grasp more opportunities and better strategies for tackling climate change.

The income from agricultural activities of farmers in the studied area is one of the factors influencing their capacity to adapt to climate change. Individuals with more income can have more equipment and facilities, resulting in an increase in their level of awareness and, consequently, an increase in their adaptation with climate change. The results of Bekele and Drake (2003), Jamshidi et al. (2015) and Khalidi et al. (2015) are consistent with the results of the research.

Participation of family members in agricultural work is another factor affecting the capacity to adapt to climate change. The

number of children in rural families is usually higher than that in urban families, and the relationship of children with informational centers and the urban environment is higher, so the awareness of children is greater than that of parents. Their participation in agricultural activities increases the likelihood of adaptation. The results of Khalidi et al. (2015) are consistent with this conclusion.

The results show the effect of family size, as well as the effect of the number of people over the age of 60 in the family, on the adaptation capacity of wheat farmers in the study area. The reason for this is also clear. The smaller the number of family members, the easier it is to decide on adaptation, and there is a negative relationship between age and adaptive capacity. People over the age of 60 are less likely to be fit for the younger ones. The research results are consistent with Campbell et al. (2011), Khalidi et al. (2015), and Vincent (2007).

The land area of farmers in the study area is another factor influencing their capacity to adapt to climate change. Land is one of the main factors in agricultural activity in the countryside. Farmers who have more land are likely to increase their efforts and their communication, and this will affect their adaptation to climate change. Jamshidi et al. (2015), Khalidi et al. (2015) and Wheeler et al. (2013), corroborate our results.

The results of the study indicate that the age of the farmers in the studied area influences their capacity to adapt to climate change. Age has a negative relationship with adaptation capacity. That is, as the age increases, adaptation capacity decreases, and younger farmers have higher adaptation capacity. Campbell et al. (2011), Deressa et al. (2008), Khalidi et al. (2015)and Wheeler et al. (2013) agree with this result.

RECOMMENDATIONS

According to the results of the research on the factors influencing the capacity of wheat farmers' adaptability in Gachsaran County, the following suggestions are presented:

Agricultural Jihad Service Centers in the county are suggested to organize classes on becoming more familiar with climate change and the impact of these changes on farmers' lives.

The responsible institutions, including agricultural Jihad and rural promotion houses, are suggested to encourage agricultural graduates to work in the agricultural sector through various forms of paying low-interest loans and land allotment, and the equipment and technology required in this sector.

It is suggested to facilitate loan repayment and grant low-interest loans to farmers with medium-term and long-term repayment terms.

For experienced and skilled people, training and justification should be made to correct their attitudes toward climate change and adaptation to these changes.

Villagers often co-operate in farming and other activities. Therefore, to increase adaptability and to cope with climate change, it is suggested that effective cooperation be established with the formation of cooperatives and the membership of villagers in these cooperatives.

Given that there is a negative relationship between age and adaptation to climate change, it is suggested that young people be used as initiators in the beginning. Because young people have a higher risk power than older farmers.

ACKNOWLEDGEMENTS

The author would like to thank MS Karandish and MS Moosaei for participating in writing and collection data.

REFERENCES

Adesina, A. A., & Forson, J. B. (1995). Farmers' perceptions and adoption of new agricultural technology: Evidence from analysis in Burkina Faso and Guinea, West Africa. *Agricultural Economics, 13*(1), 1-9.

Adger, W.N. (2001). Scales of governance and environmental justice for adaptation and mitigation of climate change. *Journal of In-*

ternational Development, 13, 921-931.

Barak, B. (2006). *Consideration for the impact of climate change information on stated preferences.* Unpublished dissertation, University of Rhode Island, United States, Rhode Island. Retrieved January 29, 2011, from Dissertations & Theses: Full Text. (Publication No. AAT 3248223).

Barnett, J. (2001). Adapting to climate change in pacific Island Countries: the problem of uncertainty. *World Development, 29*, 977-993.

Bekele, W., & Drake, L. (2003). Soil and water conservation decision behaviour of subsistence farmers in the Eastern Highlands of Ethiopia: a case study of the Hunde-Lafto area. *Ecological Economics, 46*(3), 437-451.

Below, T.B., Mutabazi, K.D., Kirschke, D., Franke, C., Sieber, S., Siebert, R., & Tscherning, K. (2012). Can farmers' adaptation to climate change be explained by socioeconomic household-level variables? *Global Environmental Change, 22*(1), 223–235.

Brooks, N., & Adger, W.N. (2005). *Assessing and enhancing adaptive capacity, adaptation policy frameworks for climate change*. Blim, E. Spanger Siegfried, I. Burton, E.L. Malone and S. Huq, Eds., Cambridge University Press, New York, PP. 165-182.

Bryan, E., Deressa, T.T., Gbetibouo, G.A., & Ringler, C. (2009). Adaptation to climate change in Ethiopia and South Africa: Options and constraints. *Environmental Science & Policy, 12*(4), 413–426.

Campbell, D., Barker, D., & McGregor, D. (2011). Dealing with Drought: Small farmers and environmental hazards in Southern St. Elizabeth, Jamaica. *Applied Geography, 31*(1), 146-158.

Deressa, T.T., Hassan, R.M., Ringler, C., Alemu, T., & Yesuf, M. (2009). Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia. *Global Environmental Change, 19*(2), 248-255.

Deressa, T.T., Hasan, R.M., Alemu, T., Yesuf, M. & Ringler, C. (2008). Analysing the Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia. IFPRI Discussion Paper, 798. Environmental and Production Technology Division, Ethiopia .Pp.1-36.

Ebi, K.L., Lim, B., & Aguilar, Y. (2005). *Scoping and designing an adaptation process, adaptation policy frameworks for climate change,* B. Lim, E. Spanger-Siegfried, I. Burton, E.L. Malone and S. Huq, Eds.. Cambridge University Press, New York, PP. 33- 46.

Ghambar Ali, R., Papzan, A. H., & Afshar Zadeh, N. (2012). Farmers' viewpoints on climate change and adaptation strategies: (Case study: Kermanshah County). *Rural Studies, 3(*3), 213-192.

Halsnæs, K., & Trærup, S. (2009). Development and climate change: A mainstreaming approach for assessing economic, social, and environmental impacts of adaptation measures. *Environmental Management* (this issue), doi: 10.1007/s00267-009-9273-0, PP. 134-144.

Idrisa, Y. L., Ogunbameru, B. O., Ibrahim, A. A. & Bawa1, D. B. (2012). Analysis of awareness and adaptation to climate change among farmers in the Sahel Savannah Agro-ecological Zone of Borno State, Nigeria. *British Journal of Environment & Climate Change, 2*(2), 216-226.

IPCC (1996). *Climate change 1995- impacts, adaptations and mitigation of climate change: Scientific- Technical Analyses, Contribution of working Group 2 to the second Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge.

IPCC, (2007). *Summary for Policy Makers, Climate change 2007: The physical science Basis, contribution of working group i to the fourth assessment report*. Cambridge University Press, Cambridge.

Jamshidi, A., Nouri Zaman Abadi, S.H., & Ebrahimi, M.S. (2015). Adaptation of farmers to climate change in Sirvan, Ilam Province: Adaptive Effects and Options. *Journal of Rural Planning and Research, 2* (10), 96-79.

Khalidi, F., Zarafshani, K., Mirakzadeh, A. A., & Sharafi, L. (2015). Investigating factors affecting farm power adaptation capacity against climate change case study: Sarpole Zahab Wheat Farmers in Kermanshah Province. *Rural Studies 6*(3), 678-655.

Khosravipour, B., Mohammadzadeh, S., Monfared, N., Khosravi, O., & Soleymanpour, M, R. (2013). Determining factors affecting agricultural behaviors against the groundwater crisis (Case Study of Deir city). *Rural Research, 4* (1), 47-23

Klein, R. J.T., & Smith, J.B. (2003). *Enhancing the capacity of developing countries to adapt to climate change: A policy relevant research agenda, Climate Change, Adaptive Capacity and Development*. J.B. Smith, R.J.T. Klein and S. Huq, Eds., Imperial College Press, London, Pp. 317-334.

Lacy S., Cleveland D., and Soleri D. (2006). Farmer Choice of Sorghum Varieties in Southern Mali, Human Ecology 34, Pp. 331–353.

Maddison, D. (2007). *The perception of and adaptation to climate change in Africa. World Bank Policy Research Working Paper, 4308*. The World Bank, Washington, DC.

Marshall, N. (2010). Understanding social resilience to climate variability in primary enterprises and industries. *Global Environmental Change, 20*(1), 36–43.

Nielsen, J., & Reenberg, A. (2010). Cultural barriers to climate change adaptation: A case study from Northern Burkina Faso. *Global Environmental Change, 20*, 142-152.

Pazoknejad, Z., & Salehi, S. (2014). Sociological analysis of farmers' coping with adverse effects of climate change, case study of Babolsar city. *Rural Research, 5*(2), 374-355.

Shushtarian, A. (2007). How will agriculture adapt to climate change? *Journal of Development and Productivity. 2*(3), 43-46.

Simpson, B. M. (2016). Preparing smallholder farm families to adapt to climate change. POCKET GUIDE 1 Extension Practice for agricultural adaptation. Download this publication and related material at: http://www.crs.org/our-work-overseas/research-publications/pocket-guide-1.

Smith, B., & Skinner, M. (2002). Adaptation options in agriculture to climate change: a typology. *Mitigation and Adaptation Strategies for Global Change*, 7(1), 85–114.

Sutherland, K., Smith, B., Wulf, V., & Nakalevu, T. (2005). Vulnerability to Climate Change and Adaptive Capacity in Samoa: the case of Saoluafata village. *Tiempo*, 54, 11-15.

Tolooei Ashlaghi, A., & Safa Kish, M., S., (2014). Analysis and interpretation of univariate and multivariate statistical tests using SPSS. Islamic Azad University, Science and Research Branch, Tehran.

Vincent, K. (2007). Uncertainty in Adaptive Capacity and the Importance of Scale. *Global Environmental Change*, 17, 12–24.

UNFCCC. (2007). Climate Change: impacts, vulnerability and adaptation in developing countries. A Report by the United Nations Framework Convention on Climate Change.

Wwheeler, S., Zuo, A., & Bjornlund, H. (2013). Farmers' climate change beliefs and adaptation strategies for a water scarce future in Australia. *Global Environmental Change, 23*(2), 537–547.

How to cite this article:
Mousaei, M. (2021). Factors affecting farmers' adaptation to climate change: A case of wheat farmers in Gachsaran, Iran. *International Journal of Agricultural Management and Development, 11*(2), 271-283. **DOR:** 20.1001.1.21595852.2021.11.2.10.4