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Research Paper

Livelihood Resilience to Climate Change in Family Farming System (Case Study: Wheat Farmers' Mahidasht in Kermanshah)

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Abstract

Over 90 percent of the agrarian system in the west of Iran is based on family farming. Thus, rural people in this region are dependent on agricultural resources, pastoral systems, and nonfarm activities for their livelihood, which has heightened their vulnerability to climate change. Therefore, this study aims to measure the livelihood resilience of family farming to climate change in Mahidasht. For this purpose, a cross-sectional descriptive study was conducted in 2018. A total of 338 wheat farmers were selected for interview on the basis of a systematic random sampling method. The instrument developed by the Speranza module was translated into the Persian language. The reliability of the questionnaire was confirmed by Cronbach's alpha and Cohen's Kappa coefficient. Results revealed that the capacity for learning was improved compared to the other components of livelihood resilience. However, less than half of all participants (44.51) did not have adequate self-organization. Based on the results, the framework proposed for measuring livelihood resilience has a holistic view and can measure all aspects of resilience. It is, thus, recommended to use this framework in the research related to this field. Moreover, livelihood resilience to climate change was found to be influenced by gender, marital status, age, and level of education. Hence, it is recommended to local planners and relevant authorities to consider these differences when developing livelihood resilience plans in the region and design their plans based on these differences.

Keywords:
Livelihood resilience; family farming; climate change

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INTRODUCTION

At present, family farming is a subject of great importance for the sustainable development of rural communities and the promotion of a healthy lifestyle. This agrarian system is the predominant form of agriculture in the food production sector in both developing and developed countries (Toader & Roman, 2015). Family farming globally accounts for 28–31 percent of total crop production and 30–34 percent of food supply on 24 percent of gross agricultural area. Farms under 2 ha devote a greater proportion of their production to food and account for greater crop diversity (Ricciardi et al., 2018). But, climate change is expected to disproportionately affect smallholders and make their livelihoods even more precarious (Harvey et al., 2014). In other words, climate change and the associated stressors influence human development through their support or destabilization of the livelihood systems of the poorest and most vulnerable people (Tanner et al., 2015; Donatti et al., 2019).

In Iran, climate change events have become more frequent and intense over recent decades. According to reports by MENA[1], Iran with 208 natural disasters, 156,332 deaths, 44,643,890 affected people, and US$ 23,492,696 damage has had the first rank from 1900 to 2015 (Ghomian & Yousefian, 2017). As such, Kermanshah province faces multiple challenges related to climate change, including droughts, heat waves, water shortage, earthquakes, and so on.

Given the extreme poverty of rural communities, the rural poor people in Kermanshah province are threatened by the loss of rural household income, food insecurity, and the excessive use of natural resources (Norouzi & Hayati, 2018). On the one hand, Kermanshah province is struggling with a high rate of migration, the vulnerability of family farming systems, and changes in average temperature. On the other hand, it has low income and small land (lesser than 10 ha). Over 90 percent of Mahidasht's estimated farming is rain-fed. Rural people in this area are dependent on agricultural resources, pastoral systems, and nonfarm activities for their livelihood. This has heightened their vulnerability to climate change. This study tries to examine livelihood resilience to climate change in Mahidasht. Several studies confirm that community resilience is a significant factor in disaster management (Alshehri et al., 2015). Resilience is a multifaceted phenomenon (Aslam Saja et al., 2018), so it does not easily lend itself for assessment, and practical methods are required for its assessment and the analysis and visualization of data. But, the few studies addressing resilience from a livelihood perspective have taken different approaches and focused only on some dimensions of livelihood. Speranza et al. (2014) present a framework that can be used for a comprehensive empirical analysis of livelihood resilience (Figure 1). Resilience has three characteristic interdependent features, namely buffer capacity, self-organization, and capacity for learning (Speranza, 2013).

The literature already shows that resilience offers a perspective to identify and examine the factors, practices, and processes that enable certain actors or social-ecological systems to moderate and overcome the adverse consequences of variability and change (Speranza, 2013). According to Folke, 'Social-ecological resilience encompasses: (1) the amount of distribution a system can absorb and still remain within the same state or domain of attraction, (2) the degree to which the system is capable of self-organization (versus lack of organization, or organization forced by external factors), and (3) the degree to which the system can build and increase the capacity for learning and adaption' (Krasny et al., 2013).

Buffer capacity is one of the main indicators that facilitate the measurement of resilience of a system (Shirali et al., 2016). In other words, buffer capacity is the capacity to absorb change and refer to the state of, and access to, livelihood assets (Jacobi et al., 2017). In this respect, Quandt et al. (2018) reveal

[1] - Middle-East and North Africa

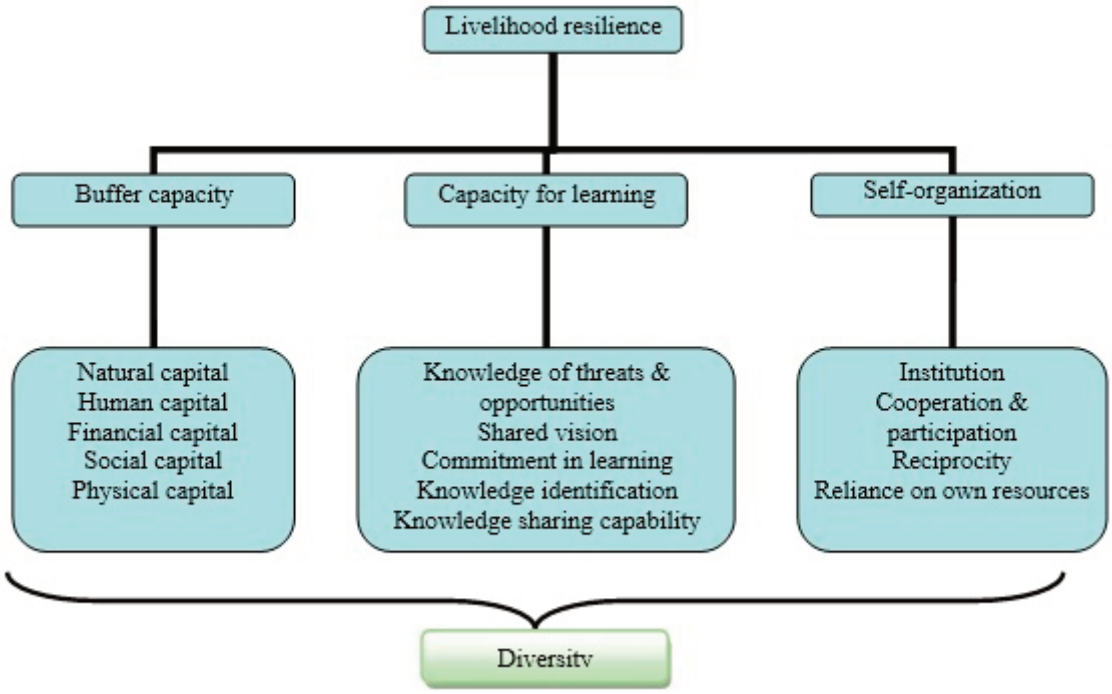

Figure 1. The theoretical framework for livelihood resilience (Speranza et al., 2014)

that the average of all five livelihood capital scores was 10 percent higher for households practicing agroforestry, indicating that those households may have more resilient livelihoods. Likewise, Quandt et al. (2018) showed that the five livelihood capitals may influence the livelihood resilience of households.

Self-organization is the ability of a system to organize itself and allows systems to learn, diversify, and become more complex and change (Mangal, 2011). According to Scally and Gardner, self-organization is useful in forecasting and publicizing hazard events, reacting in an organized and effective way to an emergency, and having in place organizations and institutions to oversee longer-term rehabilitation and reconstruction (Etkin & Haque, 2012). Pratiwi et al. (2018) report that self-organization related to the network capacity of farmers needs to be encouraged in order to interact, cooperate, and exchange learning with other organizations outside the region. Thus, the knowledge and skills of farmers as to the benefits of crop insurance and how to manage their finances will increase. This condition will contribute to enhancing the livelihood resilience of farmers to recover from extreme weather events.

By adopting social learning practices, it is possible to move beyond top-down modes of knowledge transfer towards learning that evolves with the input of various actors, which is adaptable and able to reflect on what is in/effective as it develops. If successful, this type of learning should lead to communities that have evolved to be flexible, adaptive, and strong enough to bear future shocks. This has a direct bearing on the meaning of the term resilience (Deeming et al., 2019).

As is seen, this framework (Figure 1) has a comprehensive dimension. Therefore, the present study uses this theoretical framework to answer the following questions:

-What is the status of livelihood resilience dimensions of climate change in family farming systems in Mahidasht village?

-What is the level of family farming systems in Mahidasht village in terms of livelihood re-

silience to climate change?

-Is there a significant difference between the livelihood resilience of the study population to climate changes in terms of gender, marital status, age, and level of education?

METHODOLOGY

Mahidasht is a district in Kermanshah province located in the western part of Iran (Figure 2). It is one of the main agricultural production districts. Over 90 percent of Mahidasht's estimated farming is rain-fed. Rural people in this area are dependent on agricultural resources, pastoral systems, and nonfarm activities for their livelihood. This has heightened vulnerability to climate change. This study aims to examine livelihood resilience to climate change in Mahidasht.

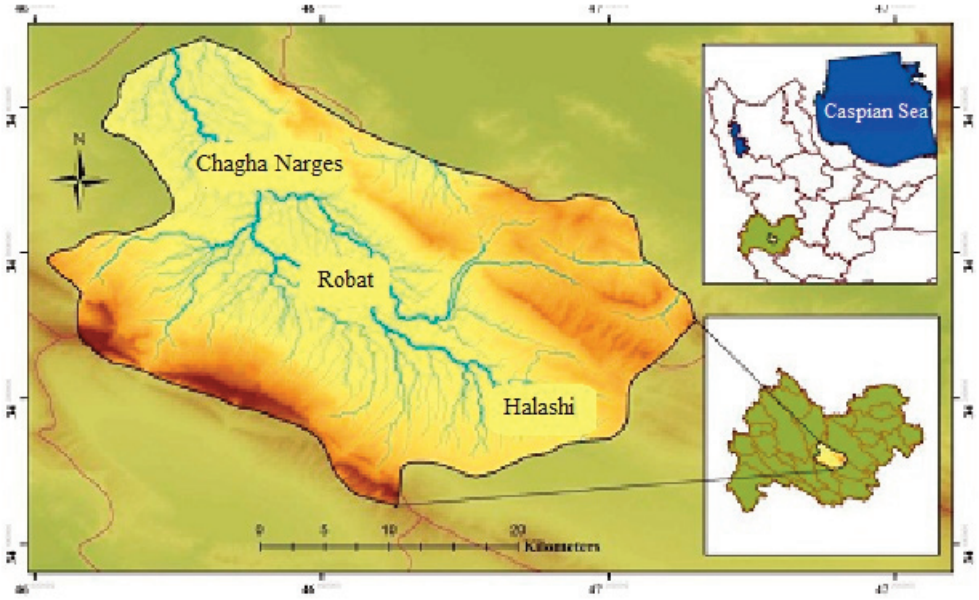

Figure 2. The location map of study area

This cross-sectional descriptive study was performed on wheat farmers of Mahidasht (N = 2800) in the year 2018. The sample size was determined by Kerjcie and Morgan's table (n=338).

The study instrument was Speranza's (2013) module, which was developed into a localized questionnaire. The questionnaire began with a brief explanation of the study aim followed by a statement indicating to the participants that their answers would be kept confidential. The questionnaire was composed of four sections pertaining to demographic characteristics, buffer capacity, self-organization, and capacity for learning. The validity of the questionnaire was ensured after its revision by Ph.D. experts in rural development and managers of the Organization of Agriculture Jahad in Kermanshah province and making some modifications as per their comments. To measure the reliability of the questionnaire, 30 questionnaires were distributed among the respondents of the study population and its reliability was assessed using Cronbach's alpha coefficient and Kappa Cohen. Both coefficients calculated for different sections of the questionnaire were higher than 0.76, indicating the appropriateness of the tool to continue the research process. Also, out of all 338 questionnaires administered, 321 questionnaires were returned, representing a return rate of 94.97 percent. The research variables are presented in Table 1.

Table 1
Variables Measuring Livelihood Resilience

Category	Components	Variable
Buffer capacity	Natural capital	Rain-fed farming (hectares), Irrigated farming (hectare), Land consolidation (Y=1/N=0), Flat lands (Likert), Soil fertility (Likert), Access to water (Likert).
	Human capital	Lack of disabled people in family (Number of people), Level of literacy (Likert), Knowledge of agriculture (Likert), Guardianship (Likert), Suitable nutrition (Likert), Health (Likert), Farm skills (Likert), Problem-solving skills (Likert), Non-farm skills (Likert), Unemployment in family (Number of people), Employment in family (Number of people), Discussion with neighbors (Likert), Ability to solve other people's problem (Likert).
	Financial capital	Insurance (Y=1/N=0), Family cost (IRR), Farming cost (IRR), Monthly installments, Non-farm income (IRR), Saving (IRR), Debt (IRR), Farm income (IRR).
	Social capital	Membership in social networks (Y=1/N=0), Trying to solve other people's problem (Likert), Assisting neighbors in need (Likert), Participation in a religious program (Likert), Trusting to neighbors (Likert), Asking help from neighbors (Likert), Participation in the rural development (Likert).
	Physical capital	Mobile (Y=1/N=0), Clinic (Y=1/N=0), Market (Y=1/N=0), Internet (Y=1/N=0), Repair shop (Y=1/N=0), Machinery (Y=1/N=0), Electricity (Y=1/N=0), Plumping gas (Y=1/N=0), Sewage system (Y=1/N=0), Phone (Y=1/N=0), Land holding (Y=1/N=0).
Capacity for learning	Knowledge of threats & opportunities	Awareness of hazard (Likert), Knowing techniques (Likert), Coping with threats (Likert), Facing opportunities (Likert), Discussion with neighbors (Likert)
	Shared vision	Access to news (Likert), Consulting with key actor (Likert)
	Commitment to learning	Farmer's access to extension service (Likert) , Access to production information (Likert), Attendance in educational class (Likert)
	Knowledge identification	Experimentation (years), Planning (Likert), Participation to access information (Likert), Openness (Likert)
	Knowledge sharing capability	New ideas and practice of farmers learnt from these actors (Likert), Interaction with key actors (Likert)
Self-organization	Institution	Existing rules and regulations governing land & water use (Likert), Enforcement of rules regulation governing land & water use (Likert)
	Cooperation & participation	Active participation in group farmer (Likert), Membership in different farmer group (Y=1/N=0), Farmer group membership (Y=1/N=0)
	Reciprocity	Assisting farmers in cultivation (Likert), Other farmers helping you (Likert), Attendance in farming meeting (Y=1/N=0)
	Reliance on own resources	Access to resources in suitable time (Likert), Preparing major inputs from own resources (Likert).

Furthermore, the indicators with different units of measurement that were necessary to use were standardized by the scale-free method to make it possible to compare them. As such, four measurement scales (5-point scale, yes/ no scale, interval scale) were used

to convert percent data into something meaningful of livelihood resilience (Table 2). Accordingly, the values were multiplied by the percentage, and the final value of all of them was presented as a percentage. It should be noted that in order to assess the status of each component of the livelihood resilience, these percentages were summed up and the mean percentages for each component were mentioned.

RESULTS AND DISCUSSION

The demographic characteristics of the participants are shown in Table 3. Most participants were men (92.9%) and data split by marital status shows that 87.5 percent were married and only a small percent were single (12.5%). The average age of the participants was 47 years (SD=9.88). The largest proportion of the survey population was in ranks lower than the high school educational level. In this respect, Mbakahya and Ndiema (2015) argue that household heads with a higher level of education have a higher level of planning, access and understanding of early warning information, better decision-making skills during natural shocks, and better skills in altering agricultural operation and adopting extension package. Thus, education is one of the key factors in building households resilient to the impact of climate change. Regarding occupation, 81.3 percent were farmers.

The respondents were asked several questions about the buffer capacity (Table 4). The results demonstrated that this component was at a moderate level. As reported by Gambo Boukary et al. (2016), access to capital significantly reduces the vulnerability and increases the resilience of farmers.

Furthermore, no disabled people were identified in the studied population. Wolbring (2009) asserted that disabled people are differently affected in all phases of a disaster. So, they could also make an important contribution to disaster reduction, often informally through participating in disaster management and acting as agents of social change. Their resilience and their networks are critical in household and community recovery and they are important as distributors of relief efforts and in reconstruction design.

Based on the results, most farmers are only skillful in agricultural work without non-farm business skills, which can affect their vulnerability capacity and decrease their resilience because they do not have any other alternative source of income. So, more frequent hazards and the loss of agricultural revenues under climate change and drought conditions make them migrate. Moreover, participants only rely on their ability to solve problems, showing that they do not expect any help from others; however, the absence of farmers groups and organizations for problem-solving is another case.

Table 2

Conversion of Three Measurement Scales into Percentage

Five-point scale Likert	No satisfied at all	Not satisfied	Somewhat satisfied	Satisfied	Very satisfied	References
Percents	0	25	50	75	100	
Nominal scale		No		Yes		Anees et al. (2013)
Percents		0		100		
Interval scale	0	Min≤A<Mean-SD	Mean-SD ≤A<Mean	Mean ≤A<Mean+SD	Mean+SD ≤A<Max	Shahrokhi et al. (2015)
Percents	0	25	50	75	100	

Table 3
Socio-Demographic Characteristic of the Respondents

Variables	Frequency (%)
Gender:	
Male	298 (92.9)
Female	23 (7.1)
Age:	
Mean ±SD	47.02 ± 9.88
Range (year)	20-60
Marital status:	
Married	281 (87.5)
Others	40 (12.5)
Education level:	
None	42 (13.1)
Primary level	90 (28.0)
High-school level	72 (22.4)
Diploma	91 (28.3)
Post-diploma	26 (9.2)
Occupation:	
Farmer	261 (81.3)
Non-farmer	60 (18.7)

According to the results, social capital is the major subcomponent of buffer capacity (65.38%). The availability of social assets to villagers is one of the important criteria in achieving sustainable rural livelihoods (Sojasi Ghidari et al., 2016). Accordingly, the amount of this capital is more appropriate than other capitals in the present research. Badri et al. (2014) demonstrated that the social capital of villagers was at a higher than moderate level. Regarding social capital, trusting neighbors, participating in religious programs, and helping neighbors are on the first to third priorities, respectively. Therefore, joining social groups and meeting neighbors on personal problems have lower priorities.

Most literature on this special issue confirms that social capital, as an asset or a source of resilience (Ledogar & Fleming, 2008), plays a central role in how communities respond to climate (Tellman et al., 2014). In other words, communities that are rich in social capital have mechanisms in place that better enable appropriate responses to planned and adverse events than those that are not (Taylor & Goodrich, 2011). Similarly, Hossain et al. (2013) observe that an excellent social relationship is an appropriate option for enhancing community resilience to climate change disaster events. Also, the results of previous studies point out that having better social networking increases the ability to cope with climate change and improves resilience (Mbakahya & Ndiema, 2015). The mean score of trusting neighbors was more than average, but the mean score of Mahidasht's farmers' visiting their neighbors on personal affairs was less than average. Yazdanpanah et al. (2017) identified that social trust affects the normal behavior of farmers against climate change. Ketabi et al. (2010) pointed out that basic and mutual trusts are appropriate. Wherever more social trust is established, the level of social participation also increases, which has been shown in this research too. Yasoori et al. (2016) described the highest impact of social trust on developing participation.

A closer look at the data in physical, human, and natural capital indicates that most of the participants reported a moderate level of these capital forms. The results showed that the majority of individuals had access to electricity, mobile phone, and private property, while access to tractors, gas piping, and sewage disposal systems was at lower priorities. Aldrich (2017) argues that preparing for disaster with an emphasis on physical infrastructural solutions, such as higher seawalls, raised floors, higher building standards, and so forth, is not sufficient to avoid the negative impacts of disasters. According to the results, the mean score of market access was estimated at a range lower than average. Supporting farming to access the credit market improves their resilience capacity and adaptation (Hang et al., 2016). According to the previous studies, individuals who have more access to credit and market are more sustainable than others (Mbakahya & Ndiema, 2015). The majority of individuals evaluated their internet access to be lower than average. The mean score of access to mechanics was less than average and more than half of the farmers did not have a tractor or agricultural equipment. Most agricultural beneficiaries of Mahidasht County have electricity and mobile phones, but the majority of them do not have access to sewer and gas piping. The results of previous research showed that the role of physical capital in the agricultural sector was more than other capitals in Iran and the yield of this input can be estimated at more than 0.3 (Omrani & Farajzadeh, 2016). Therefore, this capital impacts the sustainable development of agriculture and the high resilience of farmers. In this research, access to agricultural equipment, the Internet, and sewer and gas piping is not appropriate, decreasing the average score of physical capital.

Natural capital was assessed by examining access to natural assets (e.g., lands, fertility rate, land defragmentation, and access to irrigation water). The study on this component indicated that the natural capital of the farmers in Mahidasht County was at an average level. Prioritizing the constituent components of the natural capital also showed that the fertility rates of farms, flat and smooth farms, the amount of land defragmentation are at the first to third priorities, respectively. Access to irrigation water and irrigated lands are at the next ranks. According to Ramezani et al. (2017), access to irrigation water has been the first priority, showing the importance of water availability for agricultural activities. According to the results, nearly half of the respondents had access to just under one-hectare irrigation water and half of them had 5-10 hectare drylands. The majority of farmers had lands with personal ownership and the fertility rates of their agricultural lands were evaluated at an average level. Indeed, half of the farmers declared that the fertility rate of their lands was at an average rate. Less than half of farmers also stated that their land consolidation is at an average level. It seems that farmers' lands had a suitable condition in terms of smoothing and fertility in the studied rural areas.

Furthermore, the results showed that access to water in drought conditions has been effective in enhancing farmers' resilience. The great dependence of livelihood on natural resources, especially water, concerns communities about climate change (Pereza et al., 2015). Generally, previous studies have pointed out that smallholder farmers are more vulnerable to shocks (Ashraf, 2014). Consequently, low natural capitals can decrease resilience. Therefore, accessing fewer lands and lower fertility and also lack of access to water resources can make farmers vulnerable to environmental shocks.

Financial capital was assessed with respect to income rate, the level of agricultural costs, revenues, saving, insurance access, and receiving a loan. It indicated that the financial capital of the farmers was at a lower level than the other capitals. Financial capitals are effective factors in the livelihood of farmers and their absence can lead to an increasing level of villagers' vulnerability (Sojasi Ghidari

et al., 2016). Also, this capital can increase capacity, accelerate the recovery process, improve wellbeing, and reduce poverty.

Prioritizing indicators of financial capital revealed that agricultural costs are at the first to third levels, respectively, and insurance, saving, and off-farming income rate were at lower priorities. It is worth noting that financial capital is the financial resources that people use to achieve their livelihood goals, including income, savings, and access to credit (Pratiwi et al., 2018). Ramezani et al. (2017) showed that access to bank facilities has higher priority over increased financial capital and this variable plays a key role in the vulnerability of farmers exposed to drought. Moreover, previous results demonstrated that developing insurance networks and accessing bank facilities affect the resilience of farmers (Khaledi et al., 2015). Furthermore, credit limitations and lack of cash flow are the most important problems for agricultural manufacturers, and lack of financial resources makes them vulnerable (Makoka & Kaplan, 2005).

The investigation of the annual income of farming for farmers in Mahidasht County showed that 45.2 percent of them had an income of more than 25 million IRR per year, but 58.6 percent of farmers with the highest frequency have just less than 10 million IRR of off-farming income. In general, the share of the agricultural sector in revenue is more than the other sectors in a rural area (Salarpoor & Khodadadi Hosseini, 2016), and in this research, agricultural income was placed at the first rank in this respect. However, due to climate change, the income of agricultural and also off-farming activities impact the resilience of farmers (Khaledi et al., 2015). According to the results, 31.5 percent of farmers estimated the number of monthly expenses of households between 7000.000 IRR and 1 million IRR, and 70.4 percent stated their annual savings at a level of less than 1 million IRR. Studies have indicated that farmers' confidence in the financial capacity and the income of various activities can result in their higher resilience (Hang et al., 2016). In a study by Gambo Boukari et al. (2016), the economic index was a significant factor and had a positive effect on households' resilience.

The respondents were asked questions about the capacity for learning strategies (Table 5). Studies show that the learning capacity level of farmers is higher than the acceptable level in comparison with two other components. The key aspect of this finding is that learning capacity can be enhanced by social capital. Similarly, Wang et al. (2008) and Field (2005) argue that people's social relationships play a vital role in their capacity for learning. Likewise, Deeming et al. (2019) believes that by adopting social learning practices, it is possible to move beyond top-down modes of knowledge transfer towards learning that evolves with the input of various actors, which is adaptable and able to reflect on what is in/effective as it develops. If successful, this type of learning should lead to communities that have evolved to be flexible, adaptive, and strong enough to bear future shocks. This has a direct bearing on the meaning of the term resilience. Accordingly, this can impact increasing their resilience at the time of climate change. Basically, improvement of the learning capacity of farmers to live with risk, gain experience, and even turn risks into opportunities can promote the tolerance capacity and farmers' adaptation (Hang et al., 2016). Also, we should bear in mind that the result presented in Table 2 (as to the distribution of gender) to confirm our finding.

Investigation of learning capacity demonstrated that awareness of new techniques, access to extension specialists, and coping with the threats were ranked first to third, respectively. Hang et al. (2016) showed that one of the effective factors of resilience is the farmers' access to the experiences learned from the failure and taking new opportunities. Likewise, the results indicated that the farmers' mean access to extension specialists was more than normal. Mbakahya and Ndiema

Table 4
Buffer Capacity of Survey Respondents

Dimension	Indicators	Variables	Percents	Percent (mean)
Buffer Capacity	Human capital	Ability to solve other people's problem	64.36	57.11 (8.24)
		Level of literacy	58.00	
		Knowledge of agriculture	68.32	
		Guardianship	56.60	
		Suitable nutrition	52.80	
		Health	45.40	
		Farm skills	76.80	
		Problem-solving skills	68.84	
		Non-farm skills	44.20	
		Unemployment in family	16.71	
		Employment in family	40.80	
		Lack of disabled people in family	92.80	
		Discussion with neighbors	67.60	
	Natural capital	Access to water	49.22	53.99 (10.60)
		Irrigated cultivation	38.20	
		Land consolidation	56.57	
		Flat lands	62.30	
		Soil fertility	64.40	
		Rain fed agriculture	53.14	
	Financial capital	Farm income	77.38	44.60 (7.79)
		Cost of family	70.60	
		Cost of farming	56.80	
		Monthly installments	39.60	
		Non-farm income	33.20	
		Saving	28.00	
		Debt	52.95	
		Insurance	17.44	
	Social capital	Participation in the rural development	67.60	65.38 (12.89)
		Trying to solve other people's problem	64.00	
		Assisting neighbors in need	70.20	
		Participation in a religious program	73.40	
		Trust in neighbors	74.20	
		Helping from neighbors	52.00	
		Membership in social network	61.60	
	Physical capital	Land holding	79.40	57.72 (13.32)
		Clinic	49.40	
		Access to market	48.60	
		Internet	45.80	
		Repair shop	49.60	
		Machinery	33.00	
		Electricity	98.40	
		Plumping gas	39.30	
		Sewage system	6.50	
		Phone	59.50	
		mobile	95.30	

(2015) suggest that individuals who have more access to extension services showed more resilience against climate change. Moreover, two-thirds of farmers stated that their participation in training courses is at an average to very low level, and the mean score for obtaining information from training courses held by the Organization of Agriculture Jihad was average. Therefore, increasing access to extension specialists and training classes is crucial for raising farmers' resilience.

According to the mean of farmers' interest, access to news and new information was at an average level and their use of new methods for gaining information was less than the average level. Khaledi et al. (2015) pointed out that knowledge and awareness of farmers in terms of available innovation are determining factors of adaptation capacity to climate change. Lack of public knowledge results in lower resilience of farmers and beneficiaries (Philip & Rayhan, 2004). However, as the effective factors on production management, informing and increasing farmers' awareness can reduce the vulnerability of farmers and make them resistant to changing circumstances.

Furthermore, the findings of this research indicated that the majority of participants stated that the discussion level with neighbors for sharing information was more than average. Communication and sharing information leads to the creation of learning networks in the rural community, and this can promote knowledge of different groups. Consequently, this method of knowledge transfer has been taken into account in the studied society.

Table 5

Capacity for Learning among the Respondents

Dimension	Indicators	Variables	Percent	Percent (mean)
Capacity for learning	Knowledge of threats & opportunities	Awareness of hazard	67.16	64.01 (15.26)
		Knowing techniques	70.34	
		Coping with threats	68.50	
		Facing opportunities	50.03	
		Discussion with neighbors	67.60	
	Shared vision	Access to news	62.92	65.89 (17.05)
		Consulting with key actors	61.99	
	Commitment in learning	Access to extension service	69.71	63.63 (18.55)
		Attendance in educational class	59.81	
		Access needed production information	61.37	
	Knowledge identification	Openness	64.16	64.16 (15.22)
		Planning	65.48	
		Participation to access information	66.72	
		Experimentation	59.72	
	Knowledge sharing capability	Interaction with key actors	68.47	67.25 (16.63)
		Farmers' new ideas and practices learnt from these actors	66.04	

Based on the results, self-organization is in poor conditions in Mahidasht (Table 6). It is worth noting that self-organization related to the network capacity of farmers needs to be encouraged in order to interact, cooperate, and exchange learning with other organizations outside the region. Thus, farmers' knowledge and skills as to the benefits of crop insurance and how to manage their finances will increase. This condition will contribute to enhancing the livelihood resilience of farmers to recover from extreme weather events (Pratiwi et al., 2018). Prioritizing indicators of self-organization showed that the variable of helping neighbors in agricultural affairs was the first priority, and providing inputs from their resources and the required time for accessing inputs were on the second and third priorities, respectively. In other words, receiving help from neighbors in doing farming affairs was less than the average level, but the reciprocity over helping neighbors in doing agricultural affairs was more than average. As such, we found that bonding social capital (trusting neighbors, participating in religious rituals, assisting neighbors in need, participating in the rural development) is the most important strategy institutionalized and widely practiced among rural households in Mahidasht to support households to cope with the shocks of climate change. It may seem that these strategies connect people and facilitate the flow of resources, information, and knowledge among them. Bakker et al. (2019) confirm that a strong bonding social capital results in a resilient community identity that allows for collaboration and self-organization.

Another relevant point is that, according to Platt, lack of participation in society is one aspect of poverty (Bagherian et al., 2009). This finding is in line with our result about financial capital.

The mean of farmers' access to agricultural entities was more than average and nearly half of them obtained inputs from their resources. Self-sufficiency over inputs is not only an important step in economic growth and agricultural development (Peyvandi, 2010) but, by reducing the dependency of farmers, it can also help farmers make the best decision about managing farms with their own resources and do not have any concerns over supplying the inputs. However, according to the results, the majority of participants declared that the required time for accessing input is average to very high. Increasing the access time prevents the possibility of taking appropriate actions and may result in high vulnerability.

Approximately two-thirds of the participants do not have membership in agricultural groups and more than two-thirds are not members of any group and had not participated in any meeting during the year. The ability of individuals to participate in formal and informal institutions inside and outside their village can impact their ability to adapt to change (Pereza et al., 2015). The results of a research conducted by Khaledi et al. (2015) demonstrated that joining social organizations increases the adaptation ability for coping with climate change, but these results have also shown that farmers are weak with respect to farmers' organization in Mahidasht County and the organizations of farmers have not developed among various groups. This can have a negative effect on the self-organizing of farmers in the region and finally their resilience.

Figure 3 provides a visual overview of the dimensions of livelihood resilience score. Overall, we found that family farms in Mahidasht have allocated the largest percent of learning capacity compared to other components of livelihood resilience, whereas less than half of all participants (44.51) do not have adequate self-organization.

An independent t-test was used to investigate the difference between males and females in terms of livelihood resilience in Mahidasht County. The results are presented in Table 6. The research results showed that at the 99 percent level, there is a significant difference between male and female resilience to natural disasters so that males showed higher resilience.

Table 6
Self-Organization among the Respondents

Dimension	Indicators	Variables	Percents	Percent (mean)
Self-organization	Institution	Existing rules and regulations governing land and water use	28.60	33.55 (5.69)
		Enforcement of rules regulation governing land and water use	38.60	
	Cooperation and participation	Farmer group membership	32.64	30.75 (8.84)
		Membership in different farmer group	33.95	
		Active involvement in farmers groups	25.66	
	Reciprocity	Attendance in farming meeting	28.84	51.44 (7.80)
		Other farmers helping you	59.19	
		Assisting farmers in cultivation	66.29	
	Reliance on own resources	Preparing major inputs from own resources	64.12	62.30
		Access to resources in suitable time	60.49	

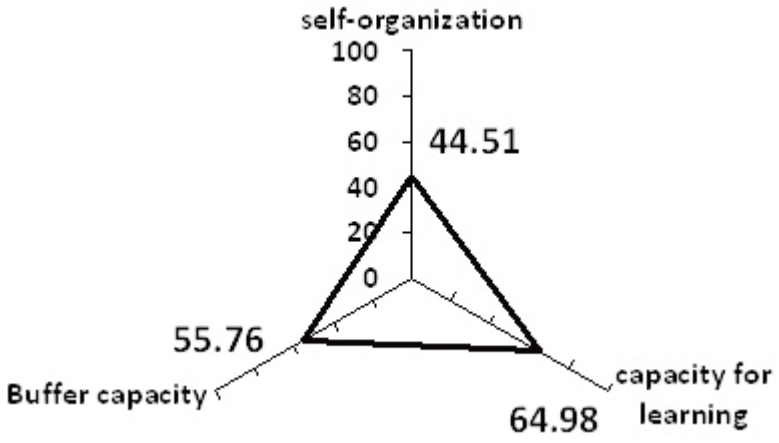

Figure 3. Priority of indicators for livelihood resilience to climate change

This result is supported by Gambo Boukari et al. (2016) and Pereza et al. (2015). Females have less access to goods or services than males. Females control less land than males and their ownership is unsafe and unreliable. Females are less considered by supportive agencies and public and private organizations, and they mainly support males. Female farmers, compared to males, make less use of modern inputs, such as advanced seeds, fertilizers, and pest control materials, as well as agricultural tools. Finally, they have less access to education. These factors increase vulnerability and reduce the resilience of females compared to males (Pereza et al., 2015) so that gender is also involved in the selection of adjustment methods (Bryan et al., 2013).

Table 7

Investigating the Difference in Livelihood Resilience in terms of Gender and Marital Status

Variable	Variable levels		n	Means	SD	t-value	*p*-value
livelihood resilience	Gender	female	23	50.30	8.90	-3.14	0.004**
		male	298	59.29	7.88		
	Marital status	single	40	51.83	8.47	-3.43	0.001**
		married	281	56.44	7.88		

** $p<0.01$

Table 8

Investigating the Differences in Livelihood Resilience of Different Age and Educational Groups

Variables	Source of variations		Sum of squares	df	Mean Square	F-value	*p*-value
Livelihood resilience	Different age groups	Between Groups	1785.77	4	446.44	7.36	0.000**
		Within Group	19169.01	316	60.66		
		Total	20954.78	320			
	Different educational groups	Between Groups	899.39	4	224.84	3.54	0.008**
		Within Group	20055.39	316	63.47		
		Total	20954.78	320			

** $p<0.01$

Moreover, investigating the livelihood resilience among participants based on marital status showed that the resilience level of married and single beneficiaries was significantly different. As the mean is higher for married people, they are in better status, because single people usually like to experience life in cities and if they are faced with adverse conditions making it harder to continue living in the village, they can easily leave the village and go to the cities (Table 7).

Then, the level of livelihood resilience among different age groups of rural farmers was investigated. The results of the F-test showed a significant difference among different age groups in the components of resilience. The LSD test showed that the age group of 50-60 had the highest mean. The F-test was used to assess the level of resilience among different educational groups. As a normal population and groups with different levels of education are completely independent of each other, the conditions to implement the F-test are met. The results are presented in Table 7 Based on the results of the LSD test, there is a significant difference between the resilience of the diploma group and that of the illiterate group and the group with only reading and wiring literacy at the level of 0.05. Based on the research conducted by Mbakahya and Ndiema (2015), farmers with higher education showed higher resistance during and after climate change. The low educational level has been considered as one of

the main causes of vulnerability (Philip & Rayhan, 2004). Khaledi et al.'s (2015) study also showed that education level was effective on farmers' adjustment (Table 8).

CONCLUSION AND RECOMMENDATIONS

The present work aimed at measuring the livelihood resilience of family farming to climate change in Mahidasht. The underlying motivation was to improve our understanding of livelihood resilience. The novelty of our approach is twofold: a) measuring livelihood resilience by the Speranza module, and b) methodological approach in which a regression design allows us to trace the relationship of gender, age, education, and marital status variables with livelihood resilience. Overall, this study provides the following conclusion and recommendations;

First, self-organization has an unsuitable situation in Mahidasht. However, several studies (Bagherian et al., 2009; Pratiwi et al., 2018) have highlighted that the importance of farmers' self-organization to enhance livelihood resilience and recover from extreme weather events. Hence, Mahidashat should be given priority by both government and donors in terms of self-organization in order to enhance their livelihood resilience to climate change. For this purpose, there is a need to encourage farmers to membership in farmer meetings and institutions.

The second finding of the study was the problem of low financial capital in Mahidasht. whereas other investigators (Khaledi et al., 2015; Pratiwi et al., 2018; Ramezani et al., 2017; Sojasi Ghidari et al., 2016) have confirmed that low financial capital significantly increases farmers' vulnerability and reduce livelihood resilience to climate change. Another relevant point is that the lack of participation (self-organization) in society is one aspect of poverty (Bagherian et al., 2009). This finding is in line with our result as to financial capital. So, there is a need to improve financial capital in Mahidasht using setting up local small and medium-sized enterprises (SMEs). Also, the development of rural tourism would help the population in such areas to diversify their income.

Third, in light of the result, most farmers are only skillful in agricultural work and lack non-farming skills. This finding was also reported by Zereyesus et al. (2017). It seems that there is a need to conduct vocational educational and training classes in Mahidasht to increase the skills and awareness of participants.

Fourth, the results highlighted that livelihood resilience to natural disasters is influenced by gender, marital status, age, and level of education. Based on the results, there is a significant difference between males and females in livelihood resilience in the face of natural disasters so that females showed lower resilience. This result is consistent with the results reported by Gambo Boukari et al. (2016) and Pereza et al. (2015). Women-headed households should be in priority of livelihood resilience plans and more efforts should be made to meet their needs. It should be noted that not all women in the family farming systems were able to access it due to statistical limitations. Hence, it is recommended to conduct separate studies on women and their livelihood resilience in natural disasters.

Fifth, based on the results of the study, married and older people have better livelihood resilience to natural disasters. It suggests that these people have seen and perceived such problems (natural disaster) and they do not readily give up to inappropriate conditions. Moreover, they have nothing else to do and have no choice but to stay in the village and continue cultivating. Similarly, previous studies have emphasized that older communities have lower resilience to climate change (Khaledi et al., 2015). Overall, age is one of the factors affecting people's resilience to climate change (Deressa et al., 2009). It seems that the decline in resilience among young people is due to the fact that they tend to be less dependent and attached to living in the village and prefer to migrate when faced with climate change problems and go to cities as a

workforce. In this regard, it is necessary to hold capacity building and rehabilitation programs and classes on resilience to natural disasters for single and young people in order to enhance the capacity of this group of audience.

Finally, this study contributed to the resilience livelihood debate by the resilience of family farming to climate change in Mahidasht. This study provides an empirical contribution on the livelihood resilience of family farming in Mahidasht from the lens of various variables by using family farming level data. Nevertheless, since our study focused only on one selected agrarian system (family farming) in the Mahidasht, the results should be interpreted as limited to this system until further more extensive data become available. Therefore, we recommend that this framework can be used in other agrarian systems such as agro-industry, production cooperatives, cash-rent, etc.

However, a major limitation of the study is that we used quantitative methodology and that we only focused on a particular system, i.e., family farming. We recommend that mix methodologies be utilized and that more than one agrarian system be assessed in future research.

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