



A Study of Factors Affecting the Drought Resilience of Farmers in Pakdasht County, Iran

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Abstract

Purpose- The consequences of drought and the damages inflicted on the rural community, which are major challenges confronting rural communities to achieve sustainable development, mirror the poor resilience of farmers against this risk. Therefore, the main issue of the current research is to explore the factors affecting Pakdasht farmers' drought resilience.

Design/Method/Approach: This paper adopts a descriptive-analytical research method. The data collection is based on library study analysis and field surveys. The main data collection instrument is a questionnaire completed by the subjects (n=381 farmers). Data analysis was conducted using SPSS software as well as t-test, regression, analysis of variance, the COCOSO technique and the COPELAND technique.

Finding- The t-test was used to investigate the drought resilience status of villagers. The socio-cultural, psychological, and economic components, except for those related to the extent of damages, environmental factors and institutional performance, and the scale of civil and physical development in the region under study, were in a balanced and favorable condition, but the items of the institutional framework, institutional relations, and technological level and infrastructure were not desirable. The correlation between researches indices in the region is 0.747, meaning that mentioned indices can explain 74% of the variances. The result of the ANOVA test suggested that the villages of Pakdasht County were not significantly different in terms of the psychological index (Sig=0.085) of resilience. Informed by the findings of the COCOSO technique, the farmers of Filestan village are more drought-resistant than the farmers in other villages. Greater participation of people, diversity of economic activities, appropriate physical and civil development, technological advancement and more suitable infrastructure are some of the factors that contribute to the higher resilience of farmers in this village. According to Copeland's method, the variables of education and awareness as well as the diversity of economic activities of the farmer's household ranked high in terms of importance.

Originality/value- The results of this research can help organizations in charge of handling drought in the villages of Pakdasht to gain deeper insights into the existing conditions so that they can enhance the resilience of farmers during drought using the presented solutions. It also allows officials to diversify economic activities and promote complementary businesses as effectively as possible.

Keywords- Resilience, Drought, COCOSO technique, Copeland's method, Pakdasht County.

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1. Introduction

The frequency of natural disasters is on the rise, especially those triggered by climate change (Malkan et al., 1400: 718). Therefore, two of the main challenges facing societies and governments are mitigating the consequences of Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). Climate change altered the frequency, intensity, spatial expansion, duration and time of extreme events and climatic hazards. Drought is one of the alarming climate events the frequency and intensity of which have escalated significantly in recent years (Zarin and Dadashi Roudbari, 2021: 107). The draught, while influencing various dimensions of economic and social activities of farmers and industries related to agriculture, also has a bearing on non-farming households living in rural areas. Mounting mental pressure and mental illnesses decreased job opportunities, reduced ability to repay agricultural loans, the rising price of staple food, soaring inflation in the society, gradual decrement of water resources, competition for access to water, social costs associated with migration and social disintegration. are other nefarious effects of drought (Sawari and Khosravipour, 2018: 21). In general, the effects of drought in rural areas can be divided into three categories: environmental effects (reduced water flows, low underground water level, soil erosion, salinity and decreased water quality, constrained plant diversity, etc.); economic effects (the rising price of agricultural and livestock products, growing demand for loans with interest rates, the mounting cost of water supply, lower food production, etc.) and social effects (diminished level of health and malnutrition issues, expansion of political-social-management conflicts, decreased quality of life, poverty, etc. (Daman Bagh et al., 2020: 96-97). The scale of damages inflicted on farmers exhibits the low flexibility of villagers' livelihoods against short-term climatic oscillations such as drought, and given the poor ability of the country's rural community to adapt to extreme events like drought, the majority of villagers prefer the strategy of emigration. However, the point that should be noted is that living in a naturally hazardous environment does not necessarily imply harm and vulnerability. Rather, the inflexibility

and poor understanding of the resident population about the scale, type and manner of risks are to be blamed (ghasemi et al., 2020: 118). The resilience approach provides huge potentials to be combined with the natural disaster management approach, including drought management. In disaster management, pre-drought (risk management) and post-drought (crisis management) actions are concomitant. By introducing the resilience approach to the measures of the disaster management cycle, a comprehensive approach to drought management can be attained, in which the adverse effects of drought can be largely mitigated by exploiting the capacities of the rural community (Malkan et al., 2021: 720).

Since natural crises are seen as a fundamental challenge to the sustainable development of human societies (Vazirian et al., 2020: 633) and drought is one of the crises confronting these societies, and considering that resilience is deemed one of the primary determinants of sustainability, which build up the capacity of societies to cope with and adapt to changes and reduce public vulnerability in the face of the probable crises in rural areas, the present research was conducted to evaluate factors affecting the resilience of farmers in the face of drought and to present strategies to enhance resilience in the villages of Pakdasht Township. Pakdasht is home to 26,000 hectares of agricultural land, which due to drought and water crisis, have largely transformed into uncultivated lands threatened by unauthorized land use change. This Township requires 1,453 liters of water per second for agricultural water, and the water extracted from 160 wells together with the water right of the Township derived from wastewater treatment only fulfills 920 liters of this demand. As a result of this agricultural water shortage, out of 26,000 hectares of arable land in Pakdasht, only 17,000 hectares are under cultivation with various crops such as wheat and barley, fodder corn and other products are grown in gardens and greenhouses because the remaining lands are fallow. Due to the water crisis and the priority of drinking water supply, from June 5, 2021, the agriculture water right of the Mamlu dam has been waived, thereby rendering agriculture in 15 villages of Pakdasht city, which were heavily dependent on the water of the Mamlu dam, virtually impossible, pushing

9 other villages to the verge of water supply crisis (30 to 70 percent). Land subsidence and landslides, as secondary consequences of drought in Pakdasht, have wreaked havoc on infrastructure facilities and agricultural lands. In recent years, at least 1.5 to 2 cm of soil drift has been documented from the southeast to northeast and west of Pakdasht, and in some areas this drift has been reported to be as great as 8 and 8.5 cm, which can be a source of the concern in these areas. Land subsidence in Varamin-Pakdasht plain is alarmingly evident, so that the severity of subsidence in this plain, with an annual average of 16 cm, has reached a total of 2 m, and in some places, the schisms are as wide as 30 m (Pakdasht Governorate, Agriculture Jihad Department of Pakdasht Township). In this regard, it can be posited that Pakdasht Township is one of the regions of the country vulnerable to the risk of drought due to its climatic conditions and geographical location. Given the impact of drought on the economic, social, institutional, infrastructure and environmental conditions of villages and considering the importance of farmers' resilience approach against drought, all factors influencing farmers' resilience against drought in the region should be identified and analyzed to be accounted for in the planning process of sustainable rural development. Therefore, in this research, an attempt has been made to gain a proper understanding of the condition of farmers and the determinants of their resilience in the villages of Pakdasht to make a proper analysis of the status quo. This analysis offers general insights into the existing conditions for planners and policymakers in the field of rural development in Pakdasht city, helping them in the process of planning to improve the resilience of villagers and farmers against drought and pave the way for desirable conditions. Given the paucity of studies in this field area and the importance of shedding light on the situation of farmers in the villages of Pakdasht Township in terms of drought resilience to formulate a comprehensive strategic plan for drought risk management, the present research aims to find answers to these questions; "What factors affect the resilience of villagers and farmers in the regional villages? What is the status of these indices in the studied villages? What are the optimal strategies to strengthen the resilience of Pakdasht farmers in the drought?"

2. Research Theoretical Literature

Among the wide range of risks threatening human societies, drought is one of the devastating natural disasters that wreak tremendous losses on the agriculture sector and water resources (Velai et al., 2020: 858). Drought, a natural part of climate which can appear in the desert or other ecosystems, is considered a serious and destructive peril to life (Kafle, 2017: 2). It can affect a massive spatial area and continue for months, and even years with catastrophic effects on socio-economic conditions, available water and agriculture. Determining the severity and frequency of drought events is of utmost importance, but quantifying drought is difficult due to its vague nature (Bhushan Jha, 2020: 137). This natural disaster not only inflicts environmental and economic effects but also gives way to a plethora of social effects on society. Also, given that it encompasses a broad geographical area than other hazards, it is more complex than other natural disasters and hence influences a greater population. The effects of drought events are reliant on a score of factors, including the type of drought (meteorology, agriculture, water resources), drought characteristics (duration, intensity, frequency), the type of agricultural system exposed to drought (cultivated land, orchards, livestock, scattered or concentrated lands), vulnerability to drought (rainy or irrigated) and the capacity of adaptation of food supply chains (Salmoral et al., 2020: 1). Recurrent droughts can simultaneously destroy natural resources and farmers' income sources (Ranjan, 2014: 105). Therefore, understanding the nature of drought, how it evolves, and how to be prepared to deal with it are key components of drought risk management to alleviate its effects. In the field of planning and policymaking, drought is deemed a "wicked problem", which may strike anytime and anywhere in the world. Drought, often referred to as a "creeping phenomenon", is more gradual than other natural disasters and is difficult to notice until it leaves its effects on a specific location and region (Poděbradská et al., 2020: 1). Talshi et al. (2016), (Spinoni & et al, 2015: 50), (Xiong & et al, 2020: 14) and (Bhushan Jha, 2020: 137) demonstrated that drought, water shortage and its effects on agricultural production and economic development are one of the major global concerns

which are linked to a host of enormous environmental, economic and social costs. Therefore, recently, in addition to other methods of evaluating and monitoring vulnerability, the concept of resilience has also been introduced as a way of evaluating the [system's recovery capacity](#) against natural disasters and adopting countermeasures against possible future accidents and disasters. In this regard, today resilience has received growing attention as a key concept in the response and introduction of countermeasures in drought ([Lee & Yoo, 2021: 1](#)). Society's resilience to tackle economic and social losses is crucial and facilitates convenient recovery in the wake of

natural disasters, which is the outcome of the advancements in risk management ([Norouzi, 2019: 74](#)). The resilience paradigm emerged in light of alteration in management stand from the crisis management approach to the risk management approach ([Ahmadi and Manouchehri, 2020: 175](#); [Kuipers and Lime, 2019: 320](#)) and today spatial resilience is recognized as a concept of confrontation with disturbances, surprises and changes ([Haji Alizadeh and Rashidi, 2020: 59](#)). [Table 1](#) outlines some definitions mentioned in the literature on resilience:

Table 1. Definitions presented in the literature on resilience

Researcher(s)	Definition
Varmazyari and Imani, 2017	Society resilience is the maintenance, development and intervention of the society's resources by its members to ensure prosperity in an environment characterized by change, uncertainty, unpredictability and unexpected events.
Ghiasvand and Abdulshah, 2015	A resilient system can absorb temporary or permanent risks and adapt to rapidly changing conditions without losing its functionality.
Karimi and Mohammadi, 2017	Resilience or the ability to adapt positively to threats is a psychological concept that has been studied in response to challenging situations.
Heydari Sarban and Majnoui, 2016	Resilience is the ability of a social or ecological system to absorb and cope with disorders or shocks so that it can maintain the basic performance structures, reorganization capacity and adaptation capacity against changes and tensions.
Badzaban et al., 2019	The members of a resilient society have a personal and shared capacity to respond to variations and their impacts to revive society and create new paths for the future.
Kafle, 2017	Resilience is a set of short-term measures that focus on short-term recovery issues rather than the root causes of risk and vulnerability.
Fanok et al, 2020	Enhanced resilience or the ability of a social cognitive system to adapt to stress and change while maintaining its primary functions and features call for a holistic view of these systems.
Mauriz, & et al, 2017	The resilience approach treats livelihood as a system and stresses two characteristics, the ability to cope and adapt to crises, which are known as key components in assessing the resilience of human societies.

The damages incurred by farmers and the repercussions of periodic droughts reflect the weak preparedness and resilience of farmers against this risk and its ramifications, as well as the inefficient crisis management systems in these cases ([Sadeghlou and Sojasi Gheidari, 2013: 130 & 131](#)). Thus, the first step to deal with drought and mitigate its adverse consequences is to construe and accurately shed light on the dimensions of people's vulnerability and resistance in order to shore up their tolerance and flexibility threshold, which is often neglected in developing countries, including Iran ([Sharifinia, 2020: 50](#)). Considering that resilience is an integral part of life in today's world ([Heidari](#)

[Sarban, 2018: 703](#)), boosting the resilience and flexibility of villagers to drought can protect them against vulnerability and fragility in face of drought. One of the notable features of resilient rural communities against drought is thresholds of change, reorganization of resistance capacity, and adaptation or recovery from shock and stress to learn and adapt ([Taleshi et al., 2017: 882](#)). The importance of exploring this issue has been the driver of effective research in diverse fields, though limited in scale. Examples include research by [Liaqat et al, 2017](#), [Sawada & Koike, 2016](#), [Salmoral et al, 2020](#), [Khan & Gomes, 2019](#), [Jafari et al., 2020](#) & [Barghi et al. 2018](#).

Table 2. An overview of research on resilience and drought

Author	Title	Results
Akbarian Ronizi et al., 2019	Analysis of farmers' resilience to drought with an emphasis on economic factors and social capital in rural areas	The results of this research suggested that: 1. Economic factors have a greater role and impact on the resilience of farmers than social capital. 2. Two indicators of the employment status, as well as the income status and savings of farmers, are significantly and directly related to extent of resilience.
Kapucu & et al, 2013	Disaster Preparedness and Resilience for Rural Communities	In this study, data from seven Central Florida areas were used to investigate rural communities and their crisis management practices, focusing on the structure of rural crisis management operations, the implementation of participatory crisis management practices, and community capacity building and the potential impacts of these practices were analyzed. The findings revealed that the challenges of crisis management in rural communities include insufficient funds, limited training opportunities and potential management capacity. The results demonstrate the great value that the statistical community attaches to forging and maintaining partnerships before and after a crisis. This result is important in that inter-agency relationships build up the capacity to tackle crises, enhance partnerships to reinforce access to limited resources and encourage the resilience of rural communities against disasters.
Nowrozi, 2019	Measuring the resilience of rural settlements against environmental hazards (Beldaji district).	Factors affecting the high level of resilience in the studied villages were: access to infrastructure services, and distance from the city centers and the districts. As far as Sibak village is concerned, which exhibited a more appropriate level of social resilience in the region, ethnicity can be regarded as a key factor.
Kamara et al., 2018	Resilience to climate-induced disasters and its overall relationship to well-being in southern Africa: a mixed-methods systematic review	Since droughts are "slow-pace" phenomena, the severity of the consequences of droughts highlights the importance of facilitating drought resilience measures for the sustained well-being and stability of affected communities. Still, the result of the field survey in South Africa showed that: 1. Resilience is poorly understood and often overlooked at times of crisis in South Africa; 2. There is a significant relationship between drought resilience and the well-being of the people in the region.
Mavhura, 2017	Applying a systems-thinking approach to community resilience analysis using rural livelihoods	Mavhura concluded that disasters provoked by natural disasters in Mozarabani region manifest as food insecurity, destruction of crops and damage to critical infrastructure.
Khosravi et al., 2019	Explaining the resilience pattern of rural settlements (Izeh city, Dehdz district) The result of this research indicates that the resilience pattern in rural settlements of Izeh city, Dehdez district	The findings of this study called for greater attention to natural dimensions in connection to resilience patterns in rural settlements of Izeh, Dehdez district. Hence, regional villages display the highest resilience in terms of natural, environmental and spatial-physical dimensions and the least resilience in institutional, management, economic and social contexts. Therefore, its risks and consequences have given rise to environmental damage, massive costs, social unrest, and the breakdown of the physical structures of the settlements.
Hosseini et al., 2021	Management of both surface and underground water resources and enhanced resilience of farmers against water shortage by predicting the price of agriculture and using a genetic algorithm	Given the importance of the agricultural sector in the national economy, for the sustainability of agriculture as a source of income, especially the production and supply of food, it is essential to underscore resources available to the farmer and the factors affecting the decision of resource allocation. This study explored the simultaneous optimization of cultivation patterns and water distribution with price forecasting in the Qazvin irrigation network in order to prevent the depletion of groundwater aquifers while exploiting

Author	Title	Results
		the available resources and paying attention to the livelihood of farmers. The results suggested that optimizing the cultivation model and water distribution can raise revenues by about 10 billion tomans.
Pishwaei et al., 2022	The role of sustainable human capital in the management of climatic drought using fitness indices in the villages of Kermanshah	It is highly important to inform people of the causes and detrimental effects of climatic drought as well as the appropriate methods of optimal water management as people can play an effective role in reducing the vulnerability of society and therefore consciously participate in this process. This is more important in rural areas due to its intimate connection with water and land issues.

The resilience of rural residents and farmers in the face of drought is classified into six main categories, including institutional-structural, social-cultural, psychological, economic, physical and environmental. Informed by resilience

components of rural residents and farmers against drought and to offer deeper insights into the components and subjects of the research, the conceptual model of the current research is presented in Figure 1.

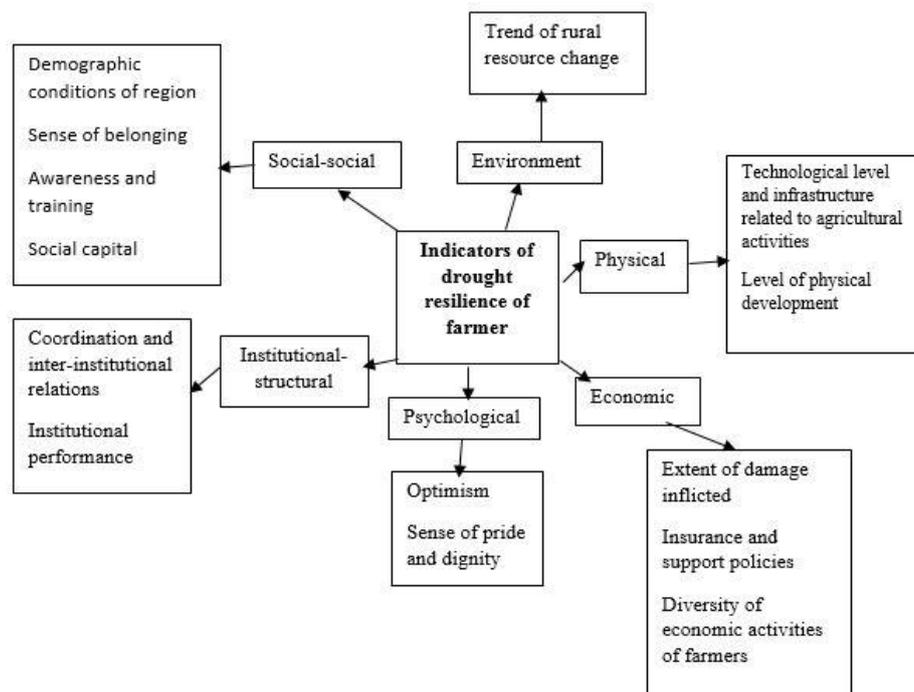


Figure 1. Conceptual model of the research

3. Research Methodology

3.1 Geographical Scope of the Research

Pakdasht County, in an area of 610 square kilometers, accounts for about 2.3% of the area of Tehran province and is located in the alluvial lands to the south of the Alborz Mountain range at an altitude of 1013 m above sea level. It is surrounded by the Alborz mountains in the north, Tehran and Shahr-e Ray in the west, the central

part of Varamin and Qarchak in the south, and Ivanki in Tehran province in the east. It consists of rural areas of Ferunabad, Hesaramir, Filestan, Karimabad, and Jamalabad (this district has a population of 29,648 people, of whom 22,990 inhabit in Shahid Namjo complex, which is bereft of any agricultural activities and only has residential purposes) and Sharifabad. Agriculture is the dominant economic activity in the villages

of this city, and the entire region is in the grips of drought. Moreover, the process of land use change has aggravated in these villages in recent years (Pakdasht Governorate, Pakdasht Agricultural Jihad Department). Since one of the fundamental solutions to bolster the sustainability of local communities against environmental crises is to

boost the resilience of these communities against the disturbance created in ecological systems, and the disaster management and sustainable development approaches seek to build resilient communities that are resistant to risks (Nowrozi, 2019: 74), the present research was conducted to address this issue in the study area.



Figure 2. Geographical location of Pakdasht villages

3.2. Methodology

To rank the villages of Pakdasht County in terms of resilience in the face of drought, the COCOSO technique was used. A new multi-criteria decision-making technique, COCOSO compromises a hybrid solution for ranking options. The steps of the COCOSO method are as follows (Akbari, 2020):

3.2. The decision matrix

The normalization of the decision matrix (the first relation is for positive criteria and the second is for negative ones);

$$r_{ij} = \frac{x_{ij} - \min_{x_{ij}}}{\min_{x_{ij}} - \max_{x_{ij}}}$$

$$r_{ij} = \frac{\max_{x_{ij}} - x_{ij}}{\min_{x_{ij}} - \max_{x_{ij}}}$$

Calculation of weighted sum and weighted product;

$$s_i = \sum(w_i r_{ij})$$

$$p_i = \sum(r_{ij})^{w_i}$$

Determining the evaluation score of the items in terms of three strategies (the first strategy denotes the arithmetic mean of the scores of the weighted sum model (WSM) and the weighted product model (WPM), while the second strategy states the relative scores of the WSM and the WPM compared to the best ones. The third strategy is a

compromise between the WSM and WPM. In this relation, λ is determined by the decision maker, but it displays high flexibility for 0.5.);

$$k_a = \frac{p_i + s_i}{\sum(p_i + s_i)}$$

$$k_b = \frac{s_i}{\min_{s_i}} + \frac{p_i}{\min_{p_i}}$$

$$k_c = \frac{\lambda s_i + (1 - \lambda)(p_i)}{\lambda \max s_i + (1 - \lambda) \max p_i}$$

Determining the final score and ranking the options.

$$k_i = (k_a k_b k_c)^{\frac{1}{3}} + \frac{1}{3}(k_a + k_b + k_c)$$

The COPELAND method, used for a broad range of subjects is meant to select the best option through a pairwise comparison. This method,

based on a pairwise comparison matrix, calculates not only the number of wins, but also the number of losses for each option.

4. Research Findings

In this research, data collection was conducted over 6 months in the summer and autumn of 2020. The statistical population comprised the villagers in rural areas of Pakdasht County, except for the Shahid Namjoo Complex. According to the Cochran formula with an error rate of 5% and a CI=95%, a sample size of n= 381 was calculated. The number of samples in each village was determined using the proportional stratified sampling method.

Table 3. The number of rural residents in each village and sample size for each village using the stratified sampling method

Source: Statistics Center of Iran (2015)

Village	Rural population	Sample size
Sharifabad	9362	69
Ferunabad	6126	45
Karimabad	7106	52
Filestan	15936	117
Jamalabad	6694	50
Hesaramir	6465	48
Total	51689	381

The main data collection instrument was a questionnaire, which consisted of two parts, demographic and professional characteristics of the respondents. The questionnaire validity was assessed by 12 experts of geography and rural planning and 7 authorities in various fields of agriculture. After applying corrections proposed

by the experts, validity was confirmed. To check the reliability of the questionnaire, a pre-test was run and reliability was calculated from Cronbach's alpha. Data analysis was performed using SPSS software, the COCOSO technique and COPELAND technique.

Table 4. Dimensions and factors affecting drought resilience of villagers and farmers

Talshi et al. (2017), Mohammadi and Manouchehri (2018), Eslami and Ebrahimi Dehkordi (2018) and Namjooyan et al., (2017), Khosravi et al. (2020), Rathi (2020).

Dimension	Factor	Item	Cronbach alpha
Social-cultural	Training and awareness	Education level, rural residents' awareness of drought, skills, local knowledge of adaptation to drought, extent and type of advisory services.	0/82
	Demographic conditions of the region	Population sex composition, population age structure, growth rate	0/78
	Sense of belonging	Reluctance to migrate, adaptation to rural life	0/80
	Social capital	Spatial attachment, the ability to return to pre-crisis conditions after the incidents, self-organization, flexibility, social networks, community adaptability, public participation	0/9

Dimension	Factor	Item	Cronbach alpha
Psychological	A sense of pride	Sense of pride for being born in a village, being proud of living in a village	0/78
	Optimism	The household's economic perspective, the psychological conditions of the villagers before and after the disaster, the perspective of agricultural activity	0/85
Economic	The extent of economic damage	The scale of damage inflicted on farms, gardens, etc., the vulnerability of villagers' property	0/81
	Insurance conditions and support policies	The status of insurance coverage, the allocation of financial credits from banks	0.89
	Diversity of economic activities	The diversity of economic activity in businesses such as tourism, the possibility of finding new jobs and sources of income	0/91
Institutional – Structural	Institutional performance	The accountability of local managers to mitigate the effects of the drought crisis	0/83
	Institutional and inter-organizational relations	The relationship of villagers and farmers with local institutions, the extent of cooperation of banks, departments and institutions in delaying the repayment of loans and allocating financial resources to grant credits to those harmed by drought.	0/92
	Institutional context	Support and effectiveness of the institutional system in bank credits and loans	85/0
Physical	The technologies and infrastructure related to agricultural activities	The agricultural and horticultural lands under mechanized cultivation, the development of agricultural mechanization	94/0
	The extent of physical development	The services available in the village, the rural appearance	79/0
Environmental	The process of changes in rural resources	Access to various kinds of water resources, natural resources of the village such as soil and forest	96/0

Of 381 distributed questionnaires, 325 were completed by the participants, and included in the statistical analysis. The analysis of demographic characteristics showed that 39.87% (n=284) of the respondents are men and 12.61% are women. People in the age range of 40-50 years constituted

the largest number of respondents. and 47.23% of the respondents had a bachelor's degree. To measure the impact of the factors affecting the drought resilience of villagers and farmers in the villages of Pakdasht County, the t-test was used, as described in [Table 5](#).

Table 5. Factors affecting the resilience of villagers and farmers in the face of drought using t-test

Research indices	Test basis = 3						Mean
	T	df	Significance level	Mean difference	95% CI		
					Lower limit	Upper limit	
Socio-cultural							
Demographic conditions of the region	9.651	324	0.000	0.680	0.541	0.818	3.680
Sense of belonging	7.212	324	0.000	0.529	0.384	0.673	3.529
Training and awareness	2.820	324	0.005	0.209	0.063	0.355	3.209
Social capital	15.457	324	0.000	0.987	0.862	1.114	3.987
Psychological							
Sense of pride and glory	5.360	324	0.000	0.473	0.299	0.647	3.473
Optimism	4.573	324	0.000	0.3847	0.219	0.550	3.384
Economic							
The scale of economic damage	-2.521	324	0.01	-0.228	-0.405	-0.050	2.722

Research indices	Test basis = 3						Mean
	T	df	Significance level	Mean difference	95% CI		
					Lower limit	Upper limit	
Insurance conditions and support policies	5.253	324	0.000	0.480	.0300	0.659	3.480
Diversity of economic activities	010/12	324	0.000	0.926	0.744	1.077	3.926
Institutional-structural							
Coordination and institutional relations	0.661	324	0.509	0.058	-0.115	0.233	3.058
Institutional context	-0.615	324	0.539	-0.055	-0.232	0.121	2.945
Institutional performance	5.252	324	0.000	0.467	0.292	0.642	3.476
Physical							
The level of technologies and infrastructure...	-1.48	324	0.252	-0.110	-0.300	0.079	2.890
The level of physical development	16.976	324	0.000	1.160	1.025	1.290	4.160
Environmental							
The process of changes in rural resources	6.010	324	0.000	0.560	0.376	0.473	3.560

As indicated by the results of the t-test, the items of institutional background and relations, the level of technological advancement and infrastructure are not desirable. It seems that the relationship of villagers and farmers with local institutions, the extent of cooperation of state departments and institutions, public participation, support and effectiveness of the institutional system in terms of bank credits and loans, the area of agricultural and horticultural lands under mechanized cultivation land, development of agricultural mechanization and modern irrigation methods in the villages are far from desirable. Hence, agriculture planners and policymakers in the region should undertake comprehensive plans in these areas. To assess the effectiveness of these indicators, the mean difference and the t-test statistic were also used. The analysis of the mean difference of the variables reveals that the impact of socio-cultural, psychological, and economic components except for items of damages inflicted, environment, institutional performance, as well as civil and physical development in the region are in a balanced and favorable condition. The desirability of these items can be the forte of these

villages meaning that optimism, supportive policies, a sense of belonging and dependence, and the diversity of economic activities in times of crisis could be a driver of rural resilience against drought. The results of data analysis suggest that the scale of economic damage incurred by farmers in recent years has aggravated the vulnerability of farmers. Changing the use of agricultural lands, the growth of greenhouses, and farmers' tendency to grow greenhouse crops such as cucumbers, eggplants, flowers, and ornamental plants, as well as tropical plants in greenhouses instead of planting watermelons, cantaloupes, pomegranates, wheat, barley, and corn, mirror a change in the style of farmers.

The correlation coefficient R indicates the linear correlation between the value of the dependent variables and the value predicted by the model. The correlation between the resilience indicators of villagers and farmers in the face of drought in the region is 0.747, denoting a direct correlation. It means that above indicators can explain 74% of variance in research variables and 26% of variance in the subject under study can be explained by other factors.

Table 6. Explaining variation in the dependent variable (drought resilience of villagers and farmers) by affective factors

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0/747	0/558	0/550	0/88351

As depicted by the variance analysis of the regression model, there is a significant relationship between various indicators (social-cultural, economic, psychological, physical, institutional-structural and environmental) at CI= 95%, and each of these indices has a bearing on the resilience status of the studied villages and can

influence other factors. The R-square (coefficient of determination) in Table 6 is 0.558, indicating that the model can explain 56% of variance in the dependent variable. Moreover, it suggests a better fit and a more important role in explaining variations in the dependent variable.

Table 7. Regression significance test of the impact model and the importance of the studied indices

Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	313.774	6	52296	66.995	0.000
	Residual	248.226	318	0.78		
	Total	562.0000	324			

The social-cultural (0.686, 68%), environmental (0.572 – 57%) and institutional-structural (0.241 – 24%) variables have the greatest standardized coefficient, thereby playing a more effective role in predicting the dependent variable, i.e., the

impact of the above variables on the resilience of villagers and farmers. As such, they play a pivotal role in the drought resilience of villagers and farmers in the villages of Pakdasht County.

Table 8. Statistics of regression model coefficients of the independent variable

Model	Non-standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	11/628	1/370		7.892	0.000
Social-cultural	0/697	0/041	0/686	16.936	0.000
psychological	0/074	0/054	0/077	1.387	0.000
Economic	0/375	0/069	0/177	3.141	0.001
Institutional-structural	0/220	0/047	0/241	4.692	0.000
Physical	0/118	0/040	0/137	2.996	0.002
Environmental	0/615	0/110	0/572	7.122	0.003

To explore the significant difference in indices affecting the resilience of villagers and farmers in the studied villages, the ANOVA method was used. Therefore, the ANOVA test and Fisher's F-test were run for all villages to determine whether the rural areas in the question are significantly different in terms of resilience. As shown in Table (10), the alpha errors (Sig) of the variance analysis are less than the acceptable error threshold (0.05). Hence, it can be argued that the

villages of Pakdasht County are significantly different in terms of resilience indices, except for the psychological index, where the alpha error rate (Sig) of variance analysis is estimated to be 0.085, which is greater than the acceptable error rate (0.05). Thus, it can be argued that the villages of Pakdasht County are not significantly different in resilience in terms of the psychological index.

Table 9. Significant analysis of the difference between villages in terms of the tourism entrepreneurship ecosystem in the rural environment

Index	Variance	Sum of squares	df	Mean square	F	Sig
Sociocultural	Inter-group	169.332	4	42.33	37.118	0.000
	Intra-group	364.957	320	1.140		
	Total	534.289	324	***		
Psychological	Inter-group	15.797	4	3.949	2.063	0.085
	Intra-group	612559	320	1.914		
	Total	628.356	324	***		
Economic	Inter-group	94.126	4	23.532	15.027	0.000
	Intra-group	501.117	320	1.566		
	Total	595.243	324	***		
Institutional - structural	Inter-group	48.210	4	12.053	5.442	0.000
	Intra-group	708.713	320	2.215		
	Total	756.923	324	***		
Physical	Inter-group	28.404	4	7.101	3.532	0.008
	Intra-group	643.424	320	2.011		
	Total	671.828	324	***		
Environmental	Inter-group	41.462	4	10.365	5.851	000/0
	Intra-group	56.895	320	1.772		
	Total	6.8.357	324	***		

Informed by the results of the COCOSO technique (Table 10), farmers in Filestan district are more drought resilient than other farmers in Pakdasht County. In the villages of this district, there are several large industrial and modern greenhouses along with companies and workshops specialized in the cultivation of flowers and ornamental plants, so Golzar village is recognized as the flower and plant hub of the country. In the villages of this district, at least 40 flower and ornamental plants exhibitions are permanently open throughout the year. The individuals

engaged in this field have necessary expertise, knowledge and skills and thanks to their strong interactions with each other, financial and credit institutions and internal and external sales markets, they are in a better position than other villages. The high participation of the people, the diversity of economic activities, proper physical and urban development, the level of technology and suitable infrastructure are some of factors associated with the greater resilience of farmers in this district.

Table 10. Calculation of ki and ranking of options

District	ka	Rank	kb	Rank	kc	Rank	ki	Rank
Karimabad	0.324	6	0.396	6	0.182	5	0.587	6
Hesaramir	0.341	5	0.452	5	0.110	6	0.972	5
Jamalabad	0.887	4	1.29	4	0.515	4	1.702	4
Ferunabad	1.138	3	1.359	3	0.681	3	2.077	3
Sharifabad	1.529	2	1.711	2	0.895	2	2.707	2
Filestan	1.882	1	2.09	1	1.087	1	3.310	1

To assess the importance of factors affecting the resilience of agricultural operators in Pakdasht County, the COPELAND technique was adopted.

The results of the Copeland technique are outlined in [Table 11](#).

Table 11. Ranking of factors influencing the resilience of agricultural operators based on the Copeland method

Criterion	$\sum C$	$\sum R$	$\sum C - \sum R$	Rank
Demographic conditions of the region	7	8	1-	9
Sense of belonging	10	5	5	6
Training and awareness	15	0	15	1
Social capital	14	1	13	2
Sense of pride and dignity	9	6	3	7
Optimism	11	4	7	5
Extent of economic damage	12	3	9	4
Insurance conditions and support policies	12	3	9	4
Diversity of economic activities of farmer households	15	0	15	1
Coordination and institutional and inter-organizational relations	13	2	11	3
Institutional background	8	7	1	8
Institutional performance	8	7	1	8
The technological level and infrastructure	11	4	7	5
The extent of physical development	7	8	1-	9
The process of resource changes in the village	14	1	13	2

According to the Copeland technique, the factors of training and awareness as well as the diversity of economic activities of the farmer's household ranked high in importance. Diversification of farmers' skills, establishment and solidification of technical and counseling centers to boost drought resilience of farmers, teaching new planting and irrigation techniques, planting crops with low water consumption, and selecting the most suitable cultivation pattern in the region and optimal water management are possible when farmers receive the essential training and are cognizant of these issues and the role of indigenous knowledge in tackling drought. Diversification of economic activities among farmers, such as the development of upstream and downstream industries associated with the products cultivated in the region will increase the return on capital, prevent immigration, and raise the income sources of farmers.

5. Discussion and Conclusion

Crises and natural hazards are deemed major challenges and obstacles to the achievement of sustainable development of rural communities. Theorists, planners and policymakers of rural development seek to secure the sustainability of rural development through models and approaches

to alleviate vulnerability via crisis management to provide favorable conditions to diminish vulnerability in the socio-economic systems of the village and consequently bolster the resilience of these settlements against environmental and climate crises. One such approach is concerned with the resilience of society against natural disasters. Given that the studied area is prone to drought and a wide spectrum of natural and human factors can influence the onset of drought and the level of farmers' resilience to it, the identification of these factors and their analysis, while proving their inter-relationships in an attempt to expand the drought resilience threshold of rural communities and achieving sustainable development in these communities, is an undeniable necessity. The present research was conducted to explore the determinants of drought resilience of farmers in Pakdasht County and shed light on the nature of these factors. In the stage of library research, 6 factors (social-cultural, economic, physical, institutional, environmental, and psychological) were identified as determinants of the drought resilience of farmers. The results of the single t-test revealed that institutional background, institutional relations and the level of technology and infrastructure are

far from desirable. As suggested by the findings of decision-makers need to first identify regional bottlenecks when amplifying resilience components. The result of the t-test demonstrated that planners and policymakers in the field of rural development in Pakdasht County should allocate special attention to the interactions of villagers and farmers with local institutions, the cooperation of state organizations and institutions, public participation, support and effectiveness of the institutional system in bank credits and loans, and accountability of local managers. Also, according to the results findings of [Kapcho et al. \(2013\)](#), inter-organizational relationships reinforce the capacity to cope with crises, promote partnerships to expand access to limited resources and encourage the resilience of rural communities against disasters. Therefore, given that institutional background and institutional and inter-organizational connections in the region are not promising, the following are suggested to strengthen these two items in a bid to build up the capacity to tackle crises.

Focus on the local management of villages, fair distribution of government facilities, improvement of conditions for granting loans to farmers, and the ongoing communication of institutions and organizations with local communities through social facilitators to develop the resilience of rural society with high adaptability and public and private sector investment to create jobs and revenues.

Moreover, to strengthen infrastructure and technological level, the following measures could be taken: developing infrastructure, providing support services to farmers in the region by building water storage tanks, granting low-interest loans from banks and credit institutions to expand modern irrigation methods in agricultural lands, promoting and expanding crops with drought-resistant cultivars.

As reported by [Nowrozi \(2018\)](#), rural resilience is the capacity of a rural area to adapt to external changes to maintain a satisfactory level of life. Hence, if planning and policymaking in all the villages of this County are geared toward nurturing the five dimensions of livelihood capital and diversifying economic activities, then aside from improving the quality of rural life by fostering resilience, the level of their consent with rural life and hope for future will also increase. In this research, an attempt was made to

gain more profound insights into the condition of villagers and farmers and the determinants of their resilience in the villages of Pakdasht County. To do so, the drought resilience of villagers and farmers was analyzed and evaluated in six institutional-structural, social-cultural, psychological, economic, physical and environmental domains. As indicated by the results of the COCOSO technique, the villages of Filestan district are more resilient. This means that resilience, by providing conditions that are conducive to creativity, revival and diversity of economic activities, triggers sustainable development. This is aligned with the findings reported by [Akbarian Ronizie et al., \(2018\)](#). The villages of Filestan district, thanks to the high quality of infrastructure, diversity of economic activity, development of greenhouse and hydroponic cultivation, development of modern irrigation methods, high education level of farmers, especially flower growers in Golzar village, and strong local management together with proper and solid connections with institutions/organizations and financial institutions and banks are more resilient and stable than other villages in Pakdasht County.

According to the findings of this research and to formulate appropriate strategies to tackle drought, the following suggestions are presented:

- 1) Strengthening the participation of villagers and farmers and fostering social capital in villages, including trust and social cohesion, in order to promote the adoption of modern cultivation and irrigation methods, especially in villages that chiefly focus on greenhouse cultivation, such as Golzar, Jitoo, Filestan, Aluak, Aramboye and Afrain;
- 2) Diversifying the economic activities of the village, including agricultural and non-agricultural activities, in order to obtain a sustainable livelihood relative to the natural and human potential of the villages in the region and the proximity to the capital, such as the development of one-day rural tourism in Golzar, Tochal, Khojir, Ghermez Tappe, etc.; paying further attention to the upstream and downstream industries related to greenhouse cultivation including ornamental plants and flowers and crops such as cucumber, tomato, papaya, pepper, etc.
- 3) Revising the existing laws and organizational structures for risk management and paying greater attention to the performance and interactions of powerful institutions and credit and banking institutions, especially in terms of granting

facilities for the development of modern greenhouses, the expansion of flower exhibitions and ornamental shrubs, entrepreneurial companies and conversion industries such as plant tissue cultivation, rose water distillation, herbal medicines, industries related to flower packaging for export, seeds and fertilizers, production of tomato paste, pickles and packaging of greenhouse products for supply to domestic markets;

4) Developing a comprehensive plan for drought within the framework of an information management, monitoring and evaluation system in the study area considering the falling precipitation and the lowering of the underground water level and providing strategic plans to optimally exploit surface water resources such as Jajrud river, underground water and Mamlu Dam;

5) Regular evaluation and monitoring of drought risk and water resources in the region and incorporating the obtained information in the process of local development planning;

6) Organizing training and promotion courses to introduce new methods of agriculture and irrigation as well as complementary economic activities in the villages of this County in keeping with the current status of tourism, rural industries and workshop about the cultivation of flowers and ornamental plants as well as small and complementary industries linked to greenhouse products such as tomatoes, cucumbers, peppers, papaya, etc.;

7) Developing a regional model for drought resilience indicators of rural communities in Pakdasht County.

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Authors' contributions

The authors equally contributed to the preparation of this article.

Conflict of interest

The author declare no conflict of interest.

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مطالعه عوامل مؤثر بر تاب‌آوری کشاورزان در برابر خشکسالی در شهرستان پاکدشت، ایران

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چکیده مبسوط

۱. مقدمه

خشکسالی از جمله رویدادهای فرین اقلیمی نگران‌کننده‌ای است که فراوانی و شدت آن به‌طور قابل‌توجهی در مهر و موم‌های اخیر افزایش یافته است. با توجه به اینکه تاب‌آوری یکی از مهم‌ترین عوامل تحقق پایداری در نظر گرفته می‌شود که سبب ارتقای ظرفیت جوامع برای مقابله و تطبیق با تغییرات گسترده و کاهش میزان آسیب‌پذیری افراد در مواجهه با بحران‌های پیش رو در فضاهای روستایی می‌باشد، لذا پژوهش حاضر با هدف ارزیابی و مطالعه عوامل مؤثر بر تاب‌آوری کشاورزان در مواجهه با خشکسالی و ارائه راهبردهای ارتقای تاب‌آوری در روستاهای شهرستان پاکدشت انجام شده است. شهرستان پاکدشت دارای ۲۶ هزار هکتار اراضی کشاورزی است که به دلیل خشکسالی و بحران آب بخش عمده‌ای از این زمین‌ها بدون کشت رها شده و در خطر تغییر کاربری غیرمجاز قرار دارد. با توجه به اهمیت شناخت وضعیت کشاورزان روستاهای شهرستان پاکدشت از منظر تاب‌آوری در برابر خشکسالی جهت تدوین برنامه جامع راهبردی در زمینه مدیریت مخاطره خشکسالی لذا در پژوهش حاضر، نگارنده به دنبال یافتن پاسخ برای این سؤالات است؛ چه عواملی بر تاب‌آوری روستائیان و کشاورزان در روستاهای منطقه تأثیر می‌گذارد؟ وضعیت این شاخص‌ها در روستاهای مورد مطالعه چگونه است؟ راهبردهای مطلوب به‌منظور تقویت تاب‌آوری کشاورزان شهرستان پاکدشت در شرایط خشکسالی چیست؟

۲. مبانی نظری تحقیق

از میان دامنه گسترده‌ای از مخاطرات که جوامع انسانی در معرض آن قرار دارد، خشکسالی از مهم‌ترین بلاهای طبیعی است که زبان‌های بسیاری را بر بخش کشاورزی و منابع آبی وارد می‌کند. تأثیرات رخداد خشکسالی به عوامل زیادی بستگی دارد از جمله نوع خشکسالی (هواشناسی، کشاورزی، منابع آب)، ویژگی‌های خشکسالی (مدت‌زمان، شدت، فراوانی)، نوع سیستم کشاورزی در معرض خشکسالی (زمین مزروعی، باغات، دامداری، اراضی پراکنده یا متمرکز)، حساسیت آن به خشکی (دیم یا آبیاری شده) و ظرفیت سازگاری زنجیره‌های تأمین غذا. اخیراً علاوه بر سایر روش‌های ارزیابی و پایش آسیب‌پذیری، مفهوم تاب‌آوری نیز برای ارزیابی ظرفیت‌بازایی سیستم در برابر بلاهای طبیعی و ایجاد اقدامات متقابل در برابر حوادث و بلاهای احتمالی در آینده معرفی شده است. در این راستا، امروزه تاب‌آوری به یک مفهوم مهم در واکنش و ایجاد اقدامات متقابل در خشکسالی تبدیل شده است. آسیب‌های وارده بر کشاورزان و پیامدهای وقوع خشکسالی‌های دوره‌ای خود بیانگر عدم آمادگی و تاب‌آوری کشاورزان در برابر این مخاطره و پیامدهای آن و همچنین ناکارآمدی سیستم‌های مدیریت بحران در این موارد است. با توجه به اینکه تاب‌آوری از ضروریات زندگی در دنیای کنونی می‌باشد لذا ارتقای زمینه‌های تاب‌آوری و انعطاف‌پذیری روستائیان نسبت به خشکسالی می‌تواند از آسیب‌پذیری و شکننده بودن آن‌ها در مواجهه با خشکسالی جلوگیری کند.

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فعالیت‌های اقتصادی خانوار کشاورز در رتبه اول اهمیت قرار گرفتند.

۵. بحث و نتیجه‌گیری

تحقیق حاضر باهدف شناخت عوامل مؤثر بر تاب‌آوری کشاورزان شهرستان پاکدشت در مواجهه باخشکسالی و ارزیابی و تحلیل این عوامل انجام پذیرفت. در مرحله مطالعات کتابخانه‌ای ۶ عامل (اجتماعی - فرهنگی، اقتصادی، فیزیکی - کالبدی، نهادی، محیطی، روان‌شناختی) به‌عنوان عوامل مؤثر بر میزان تاب‌آوری کشاورزان در مواجهه با خشکسالی شناسایی شدند که نتیجه آزمون تی تک نمونه‌ای نشان داد که گویه‌های بستر نهادی و روابط نهادی و سطح فناوری و زیرساخت‌ها در شرایط مطلوب قرار ندارند. بر اساس یافته‌های تکنیک کوکوسو روستاهای دهستان فیلیستان تاب‌آورتر هستند و این بدان معناست که تاب‌آوری با ایجاد شرایطی که منطبق بر خلاقیت، بازیابی و تنوع فعالیت‌های اقتصادی است سبب شکل‌گیری توسعه پایدار می‌شود. روستاهای دهستان فیلیستان به دلیل؛ کیفیت مناسب زیرساخت‌ها، تنوع فعالیت اقتصادی، توسعه کشت گلخانه‌ای و روش کشت هیدروپونیک، توسعه روش‌های نوین آبیاری، بالا بودن سطح تحصیلات کشاورزان به‌ویژه گلکاران در روستای گلزار و مدیریت محلی قدرتمند با دارا بودن ارتباط مناسب و قوی با نهادها و سازمان‌های دولتی و مؤسسات مالی و بانک‌ها نسبت به سایر دهستان‌های شهرستان پاکدشت تاب‌آورتر و پایدارتر هستند.

کلیدواژه‌ها: تاب‌آوری، خشکسالی، تکنیک کوکوسو، تکنیک آراس، شهرستان پاکدشت.

تشکر و قدرانی

پژوهش حاضر حامی مالی نداشته و حاصل فعالیت علمی نویسندگان است.

از ویژگی‌های اصلی جوامع تاب‌آور روستایی در مقابل خشکسالی می‌توان به آستانه‌های تغییر، سازمان‌دهی دوباره ظرفیت مقاومت، کنار آمدن یا بهبود پس از شوک و تنش واردشده برای یادگیری و تطبیق با آن اشاره کرد.

۳. روش‌شناسی تحقیق

پژوهش حاضر از نظر روش؛ توصیفی - تحلیلی است. روش جمع‌آوری داده‌ها ترکیبی اسنادی - میدانی است. ابزار اصلی جمع‌آوری داده، پرسشنامه بوده که توسط جامعه آماری (۳۸۱ نفر از کشاورزان) تکمیل شده است. تجزیه و تحلیل داده‌ها با استفاده از نرم‌افزار SPSS و روش‌های آماری آزمون تی، رگرسیون و تحلیل واریانس، تکنیک COCOSO و تکنیک COPELAND انجام شده است.

۴. یافته‌های تحقیق

به‌منظور بررسی وضعیت موجود تاب‌آوری روستائیان در مواجهه با خشکسالی از آزمون T استفاده شد. گویه‌های مؤلفه‌های اجتماعی - فرهنگی، روان‌شناختی، اقتصادی به جز گویه میزان خسارت‌های وارده، محیطی و گویه عملکرد نهادی و گویه سطح توسعه عمرانی و کالبدی در منطقه مورد بررسی متعادل و مطلوب است و گویه‌های بستر نهادی، روابط نهادی و سطح فناوری و زیرساخت‌ها در شرایط مطلوب قرار ندارند. میزان همبستگی بین شاخصه‌ای تحقیق در منطقه برابر ۰/۷۴۷ می‌باشد که بدان معناست؛ شاخص‌های ذکرشده توان تبیین ۷۴ درصد از تغییرات را دارا هستند. نتیجه آزمون تحلیل واریانس نشان داد میان روستاهای شهرستان پاکدشت از نظر شاخص روان‌شناختی ($\text{Sig}=0.085$) در تاب‌آوری تفاوت معناداری وجود ندارد. بر اساس یافته‌های حاصل از تکنیک COCOSO، کشاورزان دهستان فیلیستان نسبت به کشاورزان سایر دهستان‌ها از نظر خشکسالی تاب‌آورتر هستند. مشارکت بالای مردم، تنوع فعالیت‌های اقتصادی، توسعه کالبدی و عمرانی مناسب، سطح فناوری و داشتن زیرساخت‌های مناسب‌تر نسبت به سایر دهستان‌ها از عواملی هستند که سبب شده تا کشاورزان این دهستان تاب‌آورتر باشند. بر اساس تکنیک کپلند عامل آموزش و آگاهی و عامل تنوع



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