

## Article

# Challenges Threatening Agricultural Sustainability in the West of Iran: Viewpoint of Agricultural Experts

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**Abstract:** Sustainability has always been an emphasized topic in policy making and planning in the agricultural sector of developing countries. Despite this fact, sustainable agriculture has not been realized so far because of the various complex challenges in these countries. The lack of a structured scientific research on these challenges prompted us to conduct a study to fill this research gap and to create useful knowledge on this issue. In this regard, 300 Iranian agricultural experts, selected through stratified random sampling technique, were interviewed to explore and prioritize challenges threatening agricultural sustainability in the west of Iran. Findings indicated water scarcity and low productivity beside environmental and climate disasters were the most important challenges from the viewpoint of the participants. Moreover, insufficient investment in the agricultural sector and management weakness at the macro and micro levels were other significant challenges from the perspective of experts. Results of exploratory factor analysis indicated that the challenges threatening agricultural sustainability can be divided into nine categories including lack of investment and liquidity; environmental and climate disasters; scientific weakness; weakness of labor force in the agricultural sector; management problems; weakness of information systems; low agricultural productivity and lack of attention to quality; challenges related to agricultural inputs; and global challenges. This 9-factor structure, which confirmed through confirmatory factor analysis, was able to explain 67.52% of the variance related to the challenges threatening agricultural sustainability in the west of Iran.

**Keywords:** agricultural sustainability; climate disasters; global challenges; investment; management; productivity; scientific weakness



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## 1. Introduction

Despite increasing urbanization in the world [1], still more than three billion people live in rural areas and the livelihoods of more than 2.5 billion or about three-quarters of this rural population depends on agriculture [2]. In developing countries, agriculture is a major economic sector [3] and has a fundamental role in economic growth and income generation [4], alleviation of poverty [5,6], and employment development [7,8]. In particular, after the oil shocks of the 1970s, which led to the economic downturn in the world, attention to agriculture and its sustainability was seen as an important factor in the economic growth and development of these countries [9]. Based on Food and Agriculture Organization of the United Nations (FAO) [10], “Approximately three-quarters of the world’s agricultural value added is generated in developing countries, and in many of these, the agriculture sector contributes as much as 30% to gross domestic product (GDP)”. However, in recent decades, agricultural production for domestic markets and exports has not grown much, so that slow growth in production and annual fluctuations have led to increased poverty and reduced food security in these countries [11]. Simultaneously, overexploitation of natural resources on the one hand [1] and the overuse of chemical inputs on the other hand have left irreparable negative effects on the environment of these countries [8].

Agriculture is one of the most important economic sectors in Iran [12,13]. Based on The World Bank [14] statistics, agriculture constitutes 10.1% of GDP, 17% of the total employment, and 30% of the Iranian non-oil exports. While the agricultural sector is expected to produce the food needed by the country's population, to reduce dependence on the agricultural imports, and to increase agricultural exports, especially by increasing the value added of goods [15], this sector of the economy has always faced major challenges from the past [16]. As these challenges have increased, the existence of the agricultural sector, food security of the country, and livelihood of more than four million households in this sector is severely threatened [17]. Significant increase in import of agricultural products in the recent years is indicative of this claim. For example, after a short period of self-sufficiency of wheat as a staple in the community food basket, this product has once again become one of the most important imported items in the country and its import in 2014 has reached more than seven million tons. Statistical reports show imports of more than a million tons of rice in 2015. Iran is also dependent on import of livestock inputs such as barley, corn, soybean meal, and forage [18]. The results of studies in the country indicate that despite the approval of the National Plan to reduce the use of pesticides and the optimal use of chemical fertilizers, which was implemented in 1995, the use of chemical fertilizers and pesticides has increased. Production and distribution of pesticides by unauthorized sellers and lack of legal action against them beside indiscriminate use of pesticides by farmers in addition to creating the phenomenon of resistance in insects and the prevalence of secondary pests has also increased the cost and pollution of the environment [19].

The need for foreign exchange earnings from the agricultural sector and the use of its products for domestic consumption emphasizes the need to pay attention to this sector [9]. However, taking any appropriate measures for agricultural development in the first stage requires recognizing the challenges facing it. In this regard, in the recent years, researchers and administrators have theoretically and sporadically pointed out some of the challenges faced by the agricultural sector in the west of Iran. The lack of necessary investments, low productivity of crops and gardens per hectare compared with the global average [20], quantitative and qualitative decrease of subsurface resources (particularly water and soil), climatic risks, fragmentation and dispersion of farmlands [16], the exhaustion of efficient expert forces, the inadequacy of the scientific findings and technologies supplied to the sector, low quality of goods and inputs needed for production, the continuing changes in policies and the severe impact of macroeconomic policies such as enforcement of subsidy targeting law on agriculture [21] are some of the challenges raised in the agricultural sector. In spite of this issue, the gap which seen in this regard is the lack of a structured empirical study to understand these challenges. To the best of our knowledge of the published articles, no study has been done on this subject using scientific methods so far. This is while, understanding the challenges of sustainable agriculture, their importance and priority from the perspective of various groups and stakeholders involved in this sector can clarify many ambiguities and enable planners and decision makers providing more realistic solutions to solve the problems of this sector and lead it to sustainability. Among the various groups active in the agricultural sector, agricultural experts are in close contact with farmers. They have witnessed the problems of the agricultural sector closely. They also have more detailed information on the real conditions of the rural and agricultural communities. Therefore, studying the views of these people towards the challenges of the agricultural sector provides the most accurate knowledge in this regard. Based on this reality, this study looks to understand the challenges of the agricultural sector in west of Iran from the viewpoint of agricultural experts. Accordingly, the questions that this study seeks to answer are: (1) From the perspective of agricultural experts, what are the challenges facing agricultural sustainability in the west of Iran? and (2) How much is the importance of these challenges?

## 2. Materials and Methods

### 2.1. Participants

A cross-sectional survey was applied to conduct this study, because this method enables the researcher to have an in-depth understanding of the research problem across a wide area. The study population were agricultural experts working in the Agricultural organizations of the two provinces of Kurdistan and Kermanshah in the west of Iran (N = 1300). Three hundred of these people were selected based on the Cochran's formula [22] (p. 75) and stratified random sampling method for the study. For selecting the study sample, each province was considered as a stratum, and in proportion to the total number of agricultural experts working in agricultural organization of each province, the statistical sample size from the towns of each province was determined. Attempts were made to include selected experts from both line experts and staff experts. Line experts are people who are in direct contact with farmers on a daily basis, who closely observe the issues and problems of the agricultural sector and farmers, and are responsible for transmitting scientific advices to farmers and implementing agricultural programs. In contrast, staff experts are people who are often in indirect contact with farmers through line experts, and with their technical expertise, while advising line experts, are involved in agricultural planning and policy-making activities.

### 2.2. Data Collection

The data required for the research were collected using focus group interviews and a questionnaire. In the first step, four focus group interviews were conducted with agricultural experts in the Kurdistan province (15 line experts and 10 staff experts, respectively) and then with agricultural experts in Kermanshah province (13 line experts and 10 staff experts, respectively). The purpose of conducting these focus group interviews was to extract the items regarding challenges threatening agricultural sustainability from the viewpoint of experts. Conducting focus group interviews on the line and staff experts separately was based on this reasoning that line experts were likely to be more aware of the field challenges facing agricultural sustainability. It is due to their direct and close contact with farmers and the rural community. This is while staff experts were likely to be more aware of the administrative and managerial challenges related to this sector. After conducting focus group interviews and summarizing the findings, a questionnaire was designed to collect research data. The questionnaire was divided to two sections. The first section included demographic questions such as age, gender, marital status, academic degree, and job status (manager or employee) in the agriculture organization. The second section contained 46 items designed about challenges threatening agricultural sustainability. Respondents were asked to give their idea on the importance of each item on a 10-point scale (from 1 = the least importance to 10 = the most importance). Face validity of the questionnaire was evaluated and approved by a panel of experts from University of Kurdistan. Before the survey is done, the questionnaire was pre-tested with 30 agricultural experts outside of the main sample to examine its reliability by calculating Cronbach's alpha. Cronbach's alpha coefficient was calculated to be 0.76, which indicates the reliability of the designed questionnaire.

### 2.3. Analyses

Statistical analyses were carried out using SPSS and AMOS version 21. Coefficient of variation (CV) was used to prioritize the challenges threatening agricultural sustainability. Exploratory factor analysis (EFA) was used to classify the challenges threatening sustainable agriculture in limited number of factors and confirmatory factor analysis (CFA) was used to confirm the obtained factor structure.

### 3. Results

#### 3.1. Demographic Characteristics of the Studied Experts

Based on the collected data, 114 (38%) of the studied experts were female and 186 (62%) were male; 120 (40%) were line experts and 180 (60%) were staff experts. Among the respondents to the question related to marital status, 239 (79.7%) were married and 59 (19.7%) were single. In terms of academic degree, 28 (9.3%) of the respondents had an associate degree, 125 (41.7%) had a bachelor's degree, 138 (46%) had a master's degree, and 9 (3%) had Ph.D. Regarding the organizational position of the subjects, 25 (8.3%) had a managerial position. Based on the findings, the average age of the subjects was about 41 years (with a standard deviation of 9.28) and the average work experience as agricultural expert was about 16 years (with a standard deviation of 9.44).

#### 3.2. The Importance of Challenges Threatening Agricultural Sustainability

Table 1 represents challenges threatening agricultural sustainability in the west of Iran from the viewpoint of agricultural experts and the priority of these challenges in terms of importance based on the coefficient of variation (CV). Based on this table, from the viewpoint of the studied experts, reducing water resources with CV of 0.08 ( $\bar{X} = 9.19$ ;  $Sd = 0.77$ ) is the most important challenge facing agricultural sustainability in the west of Iran. After that, low yield of agricultural products per hectare and climate disasters such as flood, drought, and frost with a CV of 0.13 ( $\bar{X} = 8.70$ ;  $Sd = 1.15$ ) and 0.14 ( $\bar{X} = 9.02$ ;  $Sd = 1.28$ ), respectively, were the most important challenges from the viewpoint of the participants. In recent years, water scarcity due to overuse of this natural resource on one side and climatic phenomena such as occurrence of more than 27 severe drought events during 40 years [23] on other side has caused great damage to the agricultural sector [24–26] and even in some areas had been led to the depopulation of rural areas [27–29]. This is probably the reason why the experts under study emphasize the importance of water reduction and climatic phenomena as the two most important challenges for development of the agricultural sector.

**Table 1.** The importance of challenges threatening agricultural sustainability in Iran from the viewpoint of agricultural experts.

Challenges	Mean	Std. Deviation	CV	Priority
Water scarcity	9.19	0.77	0.08	1
Low level of yield of agricultural products per hectare	8.70	1.15	0.13	2
Climate and environmental disasters such as drought and flood	9.02	1.28	0.14	3
Insufficient investment in agriculture	8.92	1.36	0.15	4
Management weakness at the macro level	8.52	1.81	0.21	5
Management weakness at the micro level	7.80	1.73	0.22	6
Lack of liquidity and bank arrears	7.60	1.77	0.23	7
Lack of proper infrastructure for marketing of agricultural products (such as lack of development of rural roads and means of transportation, storage and export terminals)	8.05	1.91	0.24	8
Sharp increase in energy prices in the agricultural sector due to implementing the law on targeted subsidies without providing a solution to compensate for it	8.04	1.89	0.24	9
Continuous changes in the agricultural policy	8.15	2.10	0.26	10
Irregular and uncoordinated import of agricultural products	8.18	2.29	0.27	11
Farmers' dependence on the government and their lack of self-reliance	7.81	2.08	0.27	12

Table 1. Cont.

Challenges	Mean	Std. Deviation	CV	Priority
Existence of high waste of agricultural products and weakness of quality standards and technical criteria in production and supply of agricultural products	7.97	2.26	0.28	13
Small size of agricultural farms	7.95	2.22	0.28	14
Fragmentation and dispersion of farms	7.93	2.20	0.28	15
Low motivation of farmers to produce	7.88	2.18	0.28	16
Aging population of farmers	7.54	2.13	0.28	17
Low quality of goods and products	7.33	2.02	0.28	18
Insufficiency of scientific findings and technologies offered to the agricultural sector	7.29	2.04	0.28	19
Weakness of information technologies in producing accurate, coherent and timely statistics, and information about basic resources and products	8.40	0.47	.29	20
Non-application of research findings by farmers	8.01	2.33	0.29	21
Farmers' distrust towards agricultural experts	7.74	2.27	0.29	22
Lack of close and meaningful communication between academic circles and agricultural organizations	7.91	2.34	0.30	23
Farmers' unpreparedness to deal with natural disasters	7.35	2.20	0.30	24
Lack of support for smallholders' farmers	7.86	2.46	0.31	25
Lack of agricultural machinery and equipment	7.35	2.30	0.31	26
Worn out specialized machines and equipment	7.23	2.38	0.33	27
Continuation of the process of destruction of natural resources and intensification of soil erosion	6.82	2.22	0.33	28
Salinity and reduced quality of water resources	7.50	2.58	0.34	29
Unwillingness of the private sector to invest in agriculture	7.96	2.88	0.36	30
Low self-sufficiency, especially in basic products such as oilseeds	7.27	2.59	0.36	31
Insufficient attention to food health and safety	6.35	2.35	0.37	32
Training of specialists, some of whom have not touched the agricultural environments and problems of this sector	7.36	2.81	0.38	33
Increase costs for the production of all agricultural products	6.78	2.55	0.38	34
Lack of efficient specialists in the agricultural sector	6.55	2.52	0.38	35
Increased government intervention	6.99	2.71	0.39	36
Low productivity of agricultural inputs	7.04	2.83	0.40	37
Implementation of research projects without considering the real needs of farmers and the environmental conditions of the country	6.88	2.75	0.40	38
Strong dependence of livestock and poultry industry on imported inputs	6.83	2.75	0.40	39
Insufficient investment in the implementation of water supply projects, watershed management, and construction of irrigation networks and their equipment and renovation	6.94	2.85	0.41	40
Continuation of the process of land use change, improper exploitation of forests and pastures, and increase of degradation and desertification process	6.47	2.66	0.41	41

Table 1. Cont.

Challenges	Mean	Std. Deviation	CV	Priority
Low productivity of agricultural labors	6.41	2.61	0.41	42
Lack of transfer of scientific findings of academic researchers to the farm level	6.70	2.90	3	43
Low level of literacy of agricultural labors	6.46	2.75	0.43	44
Lack of timely information to farmers about climate change and phenomena such as floods and droughts	6.46	2.81	0.43	45
Global restrictions on agricultural trade	3.80	2.13	0.56	46

Insufficient investment in the agricultural sector (with CV of 0.15 ( $\bar{X} = 8.92$ ; Sd = 1.36)) and management weakness at the macro level with CV of 0.21 ( $\bar{X} = 8.52$ ; Sd = 1.81) and at the micro level with CV of 0.22 ( $\bar{X} = 8.70$ ; Sd = 1.73) were another important challenge from the viewpoint of agricultural experts that were placed in the third, fourth, and fifth priorities. Although the agricultural sector is one of the most important economic sectors in Iran and has a high potential for increasing GDP and creating employment in the country, this sector has a small share of investment, so that its share in the formation of fixed gross capital has been around 4.8% in recent years [30]. This is while, according to FAO, “the need for more and better agricultural investment in Iran is becoming increasingly crucial in the light of the trends witnessed over the past decades. With food demand on the rise due to a growing population, the country faces the challenges of higher demand for quality and safer food products whilst being confronted with resource constraints and environmental threats as well as adverse impacts of climate change. These trends evidence not only a greater demand for investment support for the agrifood sectors, but also an unequivocal need for an investment support strategy that would assist in managing the complex policy processes in these sectors” [31].

Based on Table 1, from the viewpoint of the studied experts, global restrictions on trade in agricultural products with CV of 0.56 ( $\bar{X} = 3.80$ ; Sd = 2.13) had the lowest priority among the challenges threatening agricultural sustainability. Giving the least priority to this challenge by the subjects can be due to the involvement of the agricultural sector with serious domestic challenges, which has marginalized the attention to the global challenges related to this sector.

### 3.3. Exploring Factor Structure of Challenges Threatening Agricultural Sustainability

EFA was used to classify the challenges threatening agricultural sustainability in the limited number of factors in Iran. Kaiser-Meyer-Olkin (KMO) and Bartlett’s test of Sphericity were used to determine the sampling adequacy and suitability of the data for factor analysis. The KMO coefficient always fluctuates between zero and one, which, as a general rule, if this coefficient is 0.7 or higher, indicates that the correlation between the data is suitable for factor analysis. The Bartlett test also examines the hypothesis that the observed correlation matrix is related to a community of uncorrelated items. The significance of this test indicates the correlation of items and their suitability for factor analysis. As shown in Table 2, the KMO value for the present study was about 0.86 and the Bartlett test was significant at the level of 0.001, indicating that data are suitable for factor analysis.

**Table 2.** Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett test.

<b>KMO Coefficient</b>		<b>0.856</b>
<b>Bartlett's Test of Sphericity</b>	Approx. Chi-Square	4548.41
	df	1024
		1024
	Sig.	0.000
		0.000

After confirming the suitability of the data for factor analysis, Varimax rotation was used to achieve significant factors. Findings of factor analysis indicated nine factors with eigenvalues higher than one. These nine factors together explain about 67.52% of the variance related to the challenges facing agricultural sustainability (Table 3).

**Table 3.** Extracted factors with eigenvalue and explained variance after Varimax rotation.

Percentage of Cumulative Explained Variance	Percentage of Explained Variance	Eigenvalue	Factor
15.09	15.09	3.06	1
26.38	11.29	2.27	2
35.64	9.26	1.78	3
43.62	7.98	1.59	4
49.77	6.15	1.44	5
55.33	5.56	1.27	6
60.48	5.15	1.17	7
65.16	4.68	1.06	8
67.52	2.36	1.02	9

Table 4 indicates the status of the nine factors after rotation based on placing items with a factor loading greater than 0.5 in each factor. Three items were deleted due to factor loadings of below 0.5. In order to name nine factors, the nature of the items in each factor and the most important items in each factor were considered.

**Table 4.** Items related to each factor and their factor loading after rotation.

Factor	Item	Factor Loading
Factor 1 Lack of investment and liquidity	Insufficient investment in agriculture	0.801
	Lack of agricultural machinery and equipment	0.789
	Worn out specialized machines and equipment	0.689
	Unwillingness of the private sector to invest in agriculture	0.651
	Lack of liquidity and bank arrears	0.640
	Lack of proper infrastructure for marketing of agricultural products (such as lack of development of rural roads and means of transportation, storage, and export terminals)	0.547
Factor 2 Environmental and climate disasters	Climate and environmental disasters such as drought and flood	0.775
	Salinity and reduced quality of water resources	0.764
	Continuation of the process of destruction of natural resources and intensification of soil erosion	0.692
	Water scarcity	0.615
	Continuation of the process of land use change, improper exploitation of forests and pastures, and increase of degradation and desertification process	0.605

Table 4. Cont.

Factor	Item	Factor Loading
Factor 3 Scientific weakness	Farmers' distrust towards agricultural experts	0.742
	Training of specialists, some of whom have not touched the agricultural environments and problems of this sector	0.640
	Lack of transfer of scientific findings of academic researchers to the farm level	0.621
	Non-application of research findings by farmers	0.573
	Lack of efficient specialists in the agricultural sector	0.557
	Lack of close and meaningful communication between academic circles and agricultural organizations	0.531
	Insufficiency of scientific findings and technologies offered to the agricultural sector	0.508
	Implementation of research projects without considering the real needs of farmers and the environmental conditions of the country	0.504
Factor 4 Weakness of labors in the agricultural sector	Aging population of farmers	0.762
	Low productivity of agricultural labors	0.731
	Low level of literacy of agricultural labors	0.681
	Farmers' dependence on the government and their lack of self-reliance	0.654
	Farmers' unpreparedness to deal with natural disasters	0.526
	Low motivation of farmers to produce	0.502
Factor 5 Management problems	Management weakness at the macro level	0.698
	Management weakness at the micro level	0.666
	Lack of support for smallholders' farmers	0.642
	Continuous changes in the agricultural policy	0.571
	Increased government intervention	0.515
	Insufficient attention to food health and safety	0.515
	Irregular and uncoordinated import of agricultural products	0.508
Factor 6 Weakness of information systems	Weakness of information technologies in producing accurate, coherent, and timely statistics and information about basic resources and products	0.821
	Lack of timely information to farmers about climate change and phenomena such as floods and droughts	0.613
Factor 7 Low agricultural productivity and lack of attention to quality	Low level of yield of agricultural products per hectare	0.701
	Low quality of goods and products	0.653
	Insufficient attention to food health and safety	0.650
	Existence of high waste of agricultural products and weakness of quality standards and technical criteria in production and supply of agricultural products	0.604
	Low self-sufficiency, especially in basic products such as oilseeds	0.534
Factor 8 Challenges related to agricultural inputs	Sharp increase in energy prices in the agricultural sector due to implementing the law on targeted subsidies without providing a solution to compensate for it	0.648
	Low productivity of agricultural inputs	0.631
	Small size of agricultural farms	0.526
	Fragmentation and dispersion of farms	0.505
Factor 9 Global challenges	Global restrictions on agricultural trade	0.524

#### *Factor 1: Lack of Investment and Liquidity*

Due to the nature of items in the first factor, this factor was named as “lack of investment and liquidity” in the agricultural sector. According to Table 4, the items summarized in this factor include “insufficient investment in agriculture,” “Lack of agricultural machinery and equipment,” “Worn out specialized machines and equipment,” “Unwillingness of the private sector to invest in agriculture,” “Lack of liquidity and bank arrears,” and “Lack of proper infrastructure for marketing of agricultural products (such as lack of development of rural roads and means of transportation, storage and export terminals)”. According to Table 3, this factor explains about 15.09% of the variance related to the challenges facing the agricultural sector. Lack of investment and liquidity in the agricultural sector has been emphasized in other studies, including the study of Shabani Koshalshahi et al. [32].

#### *Factor 2: Environmental and Climate Disasters*

As can be seen in Table 3, this factor explains 11.29% of the variance of agricultural sustainability challenges. According to Table 4, the constituent items of this factor include “climate and environmental disasters such as drought and flood,” “salinity and reduced quality of water resources,” “continuation of the process of destruction of natural resources and intensification of soil erosion,” “water scarcity,” and “continuation of the process of land use change, improper exploitation of forests and pastures, and increase of degradation and desertification process.” This finding is congruent with the result of studies by [16,27–29,33] which acknowledged the importance of climate and environmental disasters as an obstacle to agricultural development.

#### *Factor 3: Scientific Weakness*

Scientific weakness in the agricultural sector is also one of the challenges facing agricultural sustainability in the west of Iran. Scientific weakness includes of items “farmers’ distrust towards agricultural experts,” “training of specialists, some of whom have not touched the agricultural environments and problems of this sector,” “lack of transfer of scientific findings of academic researchers to the farm level,” “non-application of research findings by farmers,” “lack of efficient specialists in the agricultural sector,” “lack of close and meaningful communication between academic circles and agricultural organizations,” “insufficiency of scientific findings and technologies offered to the agricultural sector,” and “implementation of research projects without considering the real needs of farmers and the environmental conditions of the country” (Table 4). This factor was able to explain 9.26% of the variance of the challenges facing the agricultural development (Table 3). The existence of scientific weakness in the agricultural sector is also one of the problems that have been emphasized by many officials and experts.

#### *Factor 4: Weakness of Labor Force in the Agricultural Sector*

“Aging population of farmers,” “low productivity of agricultural labors,” “low level of literacy of agricultural labors,” “farmers’ dependence on the government and their lack of self-reliance,” “farmers’ unpreparedness to deal with natural disasters,” and “low motivation of farmers to produce” as the constituent factors of “weakness of labors in the agricultural sector” (Table 4) in total are able to explain 7.98% of the variance of challenges threatening agricultural sustainability in the west of Iran (Table 3).

#### *Factor 5: Management Problems*

Weak management in the agricultural sector is another challenge facing sustainability of this sector. According to Table 4, this factor includes items “management weakness at the macro level,” “management weakness at the micro level,” “lack of support for smallholders’ farmers,” “continuous changes in the agricultural policy,” “increased government intervention,” “insufficient attention to food health and safety,” and “irregular and uncoordinated import of agricultural products,” which in total are able to explain 6.15% of the variance of the challenges facing agricultural sustainability (Table 3).

#### Factor 6: Weakness of Information Systems

One of the problems threatening agricultural sustainability in the west of Iran is the weakness in the field of information technology, especially in relation to the production of accurate statistics on resources, products, and climatic phenomena. This factor, which is the sixth challenge for the advancement of the agricultural sector (Table 4), is able to explain 5.56% of the variance of challenges in this sector (Table 3).

#### Factor 7: Low Agricultural Productivity and Lack of Attention to Quality

As can be seen in Table 3, this factor explains 5.15% of the variance of the challenges facing agricultural sustainability. According to Table 4, the constituent items of this factor include “low level of yield of agricultural products per hectare,” “low quality of goods and products,” “insufficient attention to food health and safety,” “existence of high waste of agricultural products and weakness of quality standards and technical criteria in production and supply of agricultural products,” and “low self-sufficiency, especially in basic products such as oilseeds.” This finding confirms the results of the study of Ghanbari and Barghi [20].

#### Factor 8: Challenges Related to Agricultural Inputs

“Sharp increase in energy prices in the agricultural sector due to implementing the law on targeted subsidies without providing a solution to compensate for it,” “low productivity of agricultural inputs,” “small size of agricultural farms,” and “fragmentation and dispersion of farms” are also the eighth challenge threatening agricultural sustainability in the west of Iran (Table 4). According to Table 3, these factors are able to explain 4.68% of the variance of challenges threatening agricultural sustainability.

#### Factor 9: Global Challenges

In addition to the internal challenges facing the agricultural sector, global challenges such as “global restrictions on trade in agricultural products” are also obstacles to agricultural sustainability in the west of Iran. Based on Table 3, this factor explained 2.36% of the variance of challenges threatening agricultural sustainability. This finding confirms the results of the study of Moosavi Zonoor and Rohani [34] on the negative impact of some global restrictions on agricultural trade on Iran’s agricultural development.

### 3.4. Verifying the Factor structure of Challenges Threatening Agricultural Sustainability

Following the EFA, first-order CFA was carried out to evaluate the 9-factor structure of the challenges threatening agricultural sustainability. The tested model included factors and their related items as found in the EFA report in Table 4. The model fit indices (Table 5) indicated an acceptable model fit with  $\chi^2/df$  of 1.882, a comparative fit index (CFI) of 0.892, a goodness of fit (GFI) of 0.915, a normed fit index (NFI) of 0.901, and a root-mean-square error of approximation (RMSEA) of 0.059.

**Table 5.** Model fit indices.

Measures of Fit	Observed Value	Acceptable Value
$\chi^2/df$	1.882	$\leq 3$
Comparative fit index (CFI)	0.892	$\geq 0.90$
Goodness of fit (GFI)	0.915	$\geq 0.90$
Normed fit index (NFI)	0.901	$\geq 0.90$
Root-mean-square error of approximation (RMSEA)	0.059	$\leq 0.08$

Factor loadings for the final confirmatory model are presented in Table 6. The factor correlation matrix is available in Table 7. According to these tables, CFA substantially confirmed the results of EFA in terms of the number of factors identified and items relationship with factors.

**Table 6.** Confirmatory factor analysis (CFA) standardized factor loadings and standard errors.

Factor	Item	Standardized Factor Loadings (Standard Errors)
(A) Lack of investment and liquidity	A <sub>1</sub> **	0.797 (0.012)
	A <sub>2</sub> **	0.746 (0.014)
	A <sub>3</sub> *	0.667 (0.013)
	A <sub>4</sub> **	0.638 (0.016)
	A <sub>5</sub> *	0.624 (0.011)
	A <sub>6</sub> **	0.529 (0.014)
(B) Environmental and climate disasters	B <sub>1</sub> **	0.757 (0.009)
	B <sub>2</sub> **	0.745 (0.007)
	B <sub>3</sub> **	0.684 (0.010)
	B <sub>4</sub> *	0.632 (0.015)
	B <sub>5</sub> **	0.591 (0.011)
(C) Scientific weakness	C <sub>1</sub> *	0.732 (0.001)
	C <sub>2</sub> **	0.649 (0.020)
	C <sub>3</sub> **	0.642 (0.008)
	C <sub>4</sub> **	0.561 (0.018)
	C <sub>5</sub> *	0.539 (0.004)
	C <sub>6</sub> *	0.536 (0.013)
	C <sub>7</sub> **	0.499 (0.015)
	C <sub>8</sub> *	0.497 (0.016)
(D) Weakness of labors in the agricultural sector	D <sub>1</sub> *	0.777 (0.005)
	D <sub>2</sub> **	0.756 (0.016)
	D <sub>3</sub> *	0.53 (0.011)
	D <sub>4</sub> **	0.650 (0.002)
	D <sub>5</sub> **	0.539 (0.010)
	D <sub>6</sub> **	0.496 (0.018)
(E) Management problems	E <sub>1</sub> *	0.702 (0.010)
	E <sub>2</sub> **	0.632 (0.018)
	E <sub>3</sub> **	0.653 (0.006)
	E <sub>4</sub> *	0.578 (0.014)
	E <sub>5</sub> **	0.499 (0.005)
	E <sub>6</sub> **	0.498 (0.004)
(F) Weakness of information systems	F <sub>1</sub> *	0.853 (0.008)
	F <sub>2</sub> *	0.625 (0.002)
(G) Low agricultural productivity and lack of attention to quality	G <sub>1</sub> **	0.698 (0.011)
	G <sub>2</sub> **	0.672 (0.015)
	G <sub>3</sub> **	0.645 (0.012)
	G <sub>4</sub> **	0.598 (0.018)
	G <sub>5</sub> **	0.555 (0.003)
(H) Challenges related to agricultural inputs	H <sub>1</sub> *	0.668 (0.006)
	H <sub>2</sub> **	0.671 (0.028)
	H <sub>3</sub> *	0.510 (0.019)
	H <sub>4</sub> *	0.517 (0.021)
(I) Global challenges	I <sub>1</sub> *	0.502 (0.006)

\*\* Significant at 0.01 level. \* Significant at 0.05 level.

**Table 7.** Factors' correlation matrix.

Factors	A	B	C	D	E	F	G	H
A: Lack of investment and liquidity	–							
B: Environmental and climate disasters	0.384	–						
C: Scientific weakness	0.118	0.290	–					
D: Weakness of labors in the agricultural sector	0.461	0.281	0.11	–				
E: Management problems	0.420	0.312	0.412	0.282	–			
F: Weakness of information systems	0.367	0.553	0.351	0.334	0.512	–		
G: Low agricultural productivity and lack of attention to quality	0.387	0.451	0.230	0.467	0.348	0.470	–	
H: Challenges related to agricultural inputs	0.150	0.126	0.289	0.432	0.511	0.519	0.125	–
I: Global challenges	0.374	0.342	0.135	0.148	0.244	0.342	0.178	0.345

#### 4. Conclusions

This study added a new and structured scientific knowledge on the challenges threatening agricultural sustainability. In this regard, the viewpoint of Iranian agricultural professionals was investigated. The results showed that the reduction of water resources, low yields of agricultural products beside climate, and environmental disasters had the highest priority among the identified challenges. Participants' emphasis on the importance of water scarcity and climatic phenomena may be due to the fact that the agricultural sector and rural community in Iran have suffered so much over the years of drought, so that drought has even led to the rural depopulation in some areas of the country. In addition to the above challenges, lack of investment in agriculture and management weakness at the macro and micro levels were also among the challenges that are of great importance from the perspective of agricultural experts. On the other hand, according to the viewpoint of the agricultural experts, the global restrictions on trade in agricultural products have the lowest priority among the challenges facing the agricultural sector, which can be due to the involvement of the Iranian agricultural sector with serious domestic challenges which have reduced attention to global challenges. The results of factor analysis indicated that the challenges facing agricultural development in Iran can be divided into nine factors, including lack of investment and liquidity; environmental and climate disasters; scientific weakness; weakness of labors in the agricultural sector; management problems; weakness of information systems; low agricultural productivity and lack of attention to quality; challenges related to agricultural inputs and global challenges. While these nine factors were able to explain about 67.52% of the variance related to the challenges facing sustainable agriculture in Iran, confirmatory factor analysis confirmed the obtained 9-factor model of the challenges threatening agricultural sustainability. Overall, given that the lack of investment and liquidity is one of the challenges facing the development of the agricultural sector, encouraging and supporting individuals and the private sector to invest in agriculture and related industries through various means such as low-interest facilities, tax exemptions, reducing administrative bureaucracy to obtain a license, improvement of the insurance system of agricultural and livestock products to reduce the risk of investing in the agricultural sector, establishing cooperatives and credit funds, providing a suitable environment for easy export of agricultural products and provide large markets both globally and domestically to some extent help to solve this challenge. Environmental and climate disasters were another challenge for agricultural development that can be addressed through mitigating the severity of these disasters, and training farmers to adapt to these disasters and increase their resilience capacity. Because mitigating the severity of climate crises is difficult and requires a global consensus, the best solution is to prepare farmers to deal with them and increase their adaptability and resilience, which requires strong and effective promotional activities. Scientific weakness is another challenge that has hampered the agricultural sustainability in the west of Iran. In this regard, training

specialists who have closely touched on agricultural and rural problems and are interested in working in rural areas, establishing closer ties between academia and agricultural organizations, conducting research projects according to the real needs of farmers, and building trust among farmers can help reduce this barrier. Weakness of labors in the agricultural sector is another challenge that needs to be addressed to create the necessary incentive to produce and increase productivity in various ways, such as ensuring the purchase of agricultural products in farmers. Preventing the continuous change of policies and providing the ground and encouraging young people to work in the agricultural sector also seems to be an effective step in solving this problem. Given that managerial weakness in the agricultural sector is another challenge expressed by the experts under study, the use of qualified, specialized, and efficient people to carry out management activities and move to new management practices in the agricultural sector seems necessary. In addition to the above, improving warning and information systems for farmers on various issues related to agriculture, land integration, providing quality agricultural inputs, and supporting farmers to provide inputs and energy are other strategies that can mitigate the challenges ahead of agricultural development in the country.

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