

## An Extension Model Compatible with Drought Management in Iran

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### Abstract

The main purpose of this research was to design an extension model that is compatible with drought management in Iran. The research utilized a mixed research approach, combining both qualitative and quantitative methods. In the qualitative section, data was collected through semi-structured interviews, observation, and review of relevant sources. The participants in this section were 15 of extension experts with significant experience in drought management, selected through purposeful and snowball sampling methods. The data was analyzed using the systematic grounded theory approach with MAXQUDA10 software, following Strauss and Corbin's (1998) approach. In the quantitative section, the statistical population included experts, trainers, and professors whose field or organizational post is related to water resources, irrigation and drainage, Agricultural extension and development and drought which working full-time in the Ministry of Agricultural Jihad (N=6018). The sample size was determined using Cochran's formula, with a total of 372 participants. Structural equation modeling (SEM) and PLS software were used for data analysis. The results showed that the main components of the model were the detailed requirements of drought management (coefficient of 0.013), extensional methods of drought management (0.033), contextual conditions (0.1011), supporting conditions (0.166), conditions and causes (0.102), and consequences of drought management (0.065). Finally, an extension model compatible with drought management in Iran was presented.

**Keywords:** drought management, extension model, adaptation. Supporting conditions Contextual conditions

### Introduction

Drought is an extreme climatic phenomenon that occurs throughout the world, especially in arid and semi-arid regions, with different intensities and leaves harmful effects on surface and underground water resources, agriculture, economy, and generally all aspects of life. Given Iran's location in the arid and semi-arid belt of the world, it is crucial to study drought as a widespread

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30 natural disaster with long-term effects in different sectors (Kheyri et al., 2021). It can be said that  
31 drought is a climatic reality in Iran, considering that 27 droughts have occurred in this country over  
32 the last 40 years (Zarafshani et al., 2016). Drought and its undesirable consequences for natural  
33 resources, agricultural production, and economic and social development are some of the  
34 fundamental challenges of Iran and drought-prone regions, and considering the frequency and  
35 significant extent of its occurrence, it is essential to implement directional mechanisms to  
36 counteract it (Savari & Skandari Damaneh, 2020; Solh & Van Ginkel, 2014). According to a UN  
37 report, 18 countries in the world will face water shortages in the near future, and it is predicted that  
38 more than two-thirds of the world's population will be in severe water shortage conditions by 2025  
39 (Pozzi et al., 2013; Shabanali Fami et al., 2020). These disasters are partially caused by climate  
40 change (Rahman & Alam, 2016), and developing countries are more strongly affected by their risks  
41 than other regions due to deficient knowledge and adaptation to this phenomenon (Xenarios et al.,  
42 2016). The main climatic problem of dry areas is not the drought itself but the attitude toward it as  
43 an ordinary natural phenomenon and the lack of regulation of various water programs and uses  
44 based on that attitude (Khorambakht et al., 2013). Due to its biological nature and strong  
45 dependence on nature, agriculture is the largest consumer of water resources in most countries. In  
46 Iran approximately, 88% of water resources are used in agriculture (Pouralimoghaddam, 2022).  
47 Rural communities always face many effects of drought, including economic and social problems,  
48 which should not be underestimated, and a comprehensive approach is required to mitigate these  
49 impacts and achieve successful adaptation (Kiem & Austin, 2013).

50 It is undeniable that various factors contribute to the occurrence of drought. On the other hand,  
51 it is beyond human capabilities to make changes or interventions in these factors to prevent them.  
52 Nevertheless, measures can be taken in different dimensions to cope with and reduce the negative  
53 consequences of drought. Water-intensive agriculture has suffered significant damage, resulting in  
54 the losses and degradation of rangelands and pastures and the decline in livestock numbers and  
55 productivity (FAO, 2017). Economically, drought imposes an annual loss of, on average, 6-8  
56 billion USD globally, with adverse effects on farmers' revenue (production quantity and quality)  
57 being the most significant risk (Mardy et al., 2018). Consequently, it can be inferred that drought  
58 substantially threatens agriculture-based communities (Campbell et al., 2011; Fanni et al., 2016),  
59 impacting the productive, economic, social, and environmental sectors (Naderi & Karami  
60 Dehkordi, 2019). Various studies have indicated that drought has numerous social effects,

61 including reduced social welfare, physical and mental health decline, increased social isolation,  
62 heightened conflicts, decreased trust and cohesion, lowered social capital, increased suspicion  
63 toward governmental institutions, longer working hours, decreased leisure time, increased divorce  
64 rates, and destabilized family systems, posing a fundamental challenge to farmers' livelihood  
65 stability (Keshavarz & Karami, 2010; Keshavarz et al., 2013). Therefore, communities exposed to  
66 drought are vulnerable to a lower standard of living (De Silva & Kawasaki, 2018). In this regard,  
67 improving farmers' capacity in areas like adaptation and resilience in climatic conditions is  
68 necessary to sustain livelihoods (Alam et al., 2016), along with strategies for adapting to water  
69 scarcity and drought conditions (Yazdanpanah et al., 2015). In this context, the overall objective  
70 of this research was to design a model of extension compatible with drought management in Iran.

71 Climate and environmental changes significantly impact the livelihoods of communities,  
72 especially in rural areas, and affect agricultural activities in different ways (Shakouri and Merseli,  
73 2018). Therefore, farmers need to adopt behaviors compatible with the impacts of climate change  
74 to protect their livelihoods (Savari & Eskandari Damaneh, 2019) and minimize the adverse effects  
75 of these changes (Nilsen et al., 2012). Adaptation strategies consist of mainly medium- and long-  
76 term measures that farmers employ to improve the resilience of their farming units to drought-  
77 induced stresses (Ghambarali et al., 2012). Adaptation strategies are defined in risk management  
78 and crisis management (Kheyri et al., 2021; Tavakoli et al., 2015). In general, they encompass  
79 individual, economic, social, environmental, and institutional dimensions, which directly and  
80 indirectly affect agricultural production in both predictable and unpredictable ways (Smit &  
81 Pilifosova, 2003; Deressa, 2010; Ommani, 2011; FAO, 2012; Gomez et al., 2012; Feola et al.,  
82 2015). Therefore, in agricultural and rural areas, it is impossible to rely solely on agriculture to  
83 maintain production or improve people's lives. Instead, a wide range of drought adaptation  
84 strategies must be chosen (Thieme, 2006).

85 In order to face the effects of drought, farmers need to be empowered in various economic,  
86 social and technical dimensions, and in this regard, it seems that educational and extensional  
87 activities can be implemented to improve drought management by farmers (Arayesh, 2009).  
88 Agricultural extension services not only provide information on various aspects of items mentioned  
89 but help secure agricultural related services from banks, organizations and companies. The most  
90 important functions of agriculture extension services, however, are transfer of technologies and  
91 agricultural education of farmers to equip them with sufficient and suitable alternatives and

92 solutions and place them in a decision making (Al-Zahrani et al., 2016). Optimal management,  
 93 extension, and appropriate use of water in agriculture is essential. Agricultural education experts  
 94 should implement, extensional programs to combat water scarcity at the national and provincial  
 95 levels. These programs should cover producers of agricultural and horticultural products, as well  
 96 as the implementing agents. By increasing knowledge and skills among producers and  
 97 implementing agents, we can increase the efficiency of water resources and improve the quantity  
 98 and quality of production in farms and orchards (Rahimian, 1395). One of the main challenges  
 99 faced by water conservation experts is the lack of improvement in water management, particularly  
 100 in irrigation, as well as the absence of proper organizations for farmers to promote their use of  
 101 water. This is due to the farmers' lack of awareness about the water crisis and their disregard for it,  
 102 as well as the insufficient knowledge of extension experts in providing effective plans. The low  
 103 efficiency of irrigation in agricultural lands is also a result of the lack of timely and effective  
 104 extension, leading to the waste of floodwaters. Furthermore, the absence of integrated water  
 105 resource management plans in the watershed, and the lack of appropriate farming patterns in  
 106 accordance with the sustainable capacity of water resources in the region, are also attributed to the  
 107 lack of extension experts' knowledge. Additionally, the lack of awareness among beneficiaries  
 108 about modern methods and the absence of specialized and knowledgeable experts in this field are  
 109 also major issues (Hoseinzad et al., 1392). Therefore, presenting an extensional model for irrigation  
 110 management and better coping with the drought in Iran, which leads to improved irrigation  
 111 management, increased irrigation efficiency, and improved agricultural development, is of great  
 112 importance. Table 1 provides a summary of studies regarding a extension and drought  
 113 management.

114  
 115 **Table 1.** A summary of influential variables in a model of extension compatible with drought crisis  
 116 management.

Research Title	Author	Method	Findings
Investigating the social consequences of drought on rural areas (case study: Shosef district, Nehbandan city)	Fal Suleiman et al. (2013)	Survey	In the environmental dimension, drought causes the drying up of surface water, the destruction of vegetation, and an increase in dust. In the economic aspect, the income level has decreased, the unemployment rate has increased, and agricultural and livestock production has decreased.
Extension pattern compatible with drought management in Razavi Khorasan Province, Iran	Mousavi et al. (2021)	Qualitative	Extension compatible with drought management requires cooperation and coordination between different institutions and organizations, and educational and extensional programs can significantly improve drought management.
Extension pattern compatible with drought management in Alborz province, Iran	Firouzjani (2018)	Qualitative	Planning, development, and implementation of water resources and drought management plans for each region should be based on the conditions and resources available in

Research Title	Author	Method	Findings
Development of extension pattern for drought management in Iran	Rahimi et al. (2019)	Qualitative	that region. It is also essential to educate and promote concepts related to drought management. Drought management requires the development of suitable extension models. Improving the awareness and capability of the society and water users in the field of drought management is one of the main success factors in the implementation of extensional models.
extension management using new media	Azari et al. (2017)	Qualitative	Teaching and extension the concepts related to drought management helps improve the awareness of society and farmers, improving drought management in Iran.
The perception of soil erosion and its social and economic factors in different regions of Sri Lanka.	Udayakumara et al. (2010)	Survey	agricultural workforce, household size, literacy rate, property security, conservation costs, promotional education, membership in local organizations, professional skills, financial capital, distance to land, and farm income are all important factors in understanding soil erosion in the studied region.
Drought management planning policy: from Europe to Spain	Hervás-Gámez & Delgado-Ramos (2019)	Qualitative	A key milestone in terms of European drought-risk management was set by the 2007 EC Communication “Addressing the Challenge of Water Scarcity and Droughts in the European Union”. This presented an initial set of seven policy instruments for tackling water scarcity and drought issues at European, national, and regional levels. These included options in relation to ‘putting the right price tag on water’, ‘allocating water more efficiently’, and ‘fostering water efficient technologies and practices’. The Communication also recommended the development of DMPs.
The Impacts of Drought and the Adaptive Strategies of Small-Scale Farmers in uMsinga, KwaZuluNatal, South Africa	Lottering et al.(2021)	Survey	Farmers adopted various adaptive strategies to adapt to drought such as the use of early-maturing crops, mixed cropping systems and drought-tolerant crops. With regard to mitigation, a majority of farmers did not prepare for drought, and those who did utilized indigenous methods of conserving water such as rainwater harvesting, the use of wells, and migrating for alternative employment.
Assessing agricultural drought management strategies in the Northern Murray–Darling Basin	Aitkenhead et al.(2021)	Qualitative	Government Assistance is the most used ADMS for Paroo Shire, the Maranoa Region and Murweh Shire. Whereas the MDB Plan is mainly used in the Goondiwindi Region.

117

## 118 Materials and Methods

119 This study used a cross-sectional methodology and a survey to gather descriptive data for a  
 120 practical goal. Employing a mixed approach, incorporating both quantitative and qualitative  
 121 methods (Johanson and Onwuegbuzie, 2004). In the initial stage of this research, data collection  
 122 methods included semi-structured interviews, observation, and review of relevant sources. The  
 123 systematic grounded theory with MAXQUDA10 software was used for data analysis and using  
 124 Strauss and Corbin (1998) approach. For coding which includes three stages of coding: open  
 125 coding, axial coding and selective coding (Lee, 2001; Creswell and Creswell, 2017). The  
 126 qualitative section of the study included a sample of 15 senior experts and academic members with  
 127 practical and scientific experience in drought (Table 2). They were selected using purposeful and  
 128 snowball sampling methods.

129 **Table 2.** Frequency distribution of demographic and professional characteristics of the studied  
130 people.

Characteristic	Strata	Abundance
Age Average = 48.36	<30	1
	40-31	3
	50-41	6
	60-51	5
Gender	Man	12
	Female	3
Educational level	Master's degree	4
	PhD	11
Field of study	Water and irrigation	5
	Agriculture extension	7
	agricultural development	3

131  
132 Second stage, in this section Confirmatory factor analysis, structural equation modeling and  
133 Smart-PLS software employed. For this analyze, the statistical population consisted of 6018.  
134 Experts, trainers, and faculty members whose field or organizational post is related to water  
135 resources, irrigation and drainage, drought, Agricultural extension and development sciences  
136 which were employed full-time in the Ministry of Agriculture Jihad in Iran. The statistical sample  
137 was determined using Cochran's formula. The number of samples was determined to be 372 experts  
138 (Table 3). Sampling method was Stratified Sampling

139 **Table 3:** The number of samples in each of the three fields.

category	statistical population	Sample size
Experts	4390	271
Trainers and researches	930	57
faculty members	698	43
<b>total</b>	6018	372

140  
141 **Validity and Reliability**

142 Guba, & Lincoln 1985 method was used to check reliability and validity. The indexes used were  
143 Dependability and Transferability. Based on this, re-coding was done in two different time periods  
144 and two other researchers were used. Based on the results, the Dependability index was 74% and  
145 the Transferability index was 71%. Considering that it was more than 60%, it can be said that the  
146 indicators had a favorable condition.

147 Confirmatory factor analysis was used within the SEM framework to assess the proposed  
148 model's validity (Nunnally & Bernstein, 1994, cited in Hosseinizare, 2017). To examine the  
149 reliability of the questionnaire, a pilot study was conducted with non-sampled respondents to make

150 necessary revisions. The reliability or confidence level of the variables was estimated by  
151 Cronbach's alpha coefficient (Table 4).

152 **Table 4.** Cronbach's alpha coefficient for questionnaire factors.

Row	variables	Number of items	Cronbach's alpha coefficients
1	management before drought	15	0/691
2	management after drought	11	0/701
3	management during drought	11	0/630
4	Extension system adapted to drought	13	0/941
5	Supportive policies	9	0/832
6	Consequences of drought	17	0/852
7	disseminational and educational methods	12	0/754
8	Causal conditions	14	0/775
9	Contextual conditions of drought	12	0/811

153  
154 **Research findings**

155 Examining the age of the responders showed that the highest frequency (36%) was related to  
156 the age group of 41-50 years. Also, 284 (76.3%) of the responders were male (the highest  
157 frequency), and 88 (23.7%) were female. In terms of the educational level, the highest frequency  
158 was related to the master's degree with a frequency of 194 (52.2%). Among the study fields,  
159 agricultural engineering had the highest frequency of 165 people (44.3. Regarding experience, the  
160 highest frequency was related to 11-15 years with a frequency of 136 (36.5%. (Table 5).

161  
162 **Table 5.** Frequency distribution of demographic and professional characteristics of the studied  
163 people.

Characteristic	Strata	Abundance	Percent	Cumulative percentage
Age n=372 Average = 40.46	20-30	79	3.21	3.21
	40-31	93	25	3.46
	50-41	134	36	3.82
	60-51	66	7.17	100
Gender n=372	Man	284	3.76	Mode = man
	Female	88	7.23	
Educational level Mode = Master's degree	Bachelor's degree	60	1.16	1.16
	Master's degree	194	2.52	3.68
	Ph.D.	118	7.31	100
Field of study n=218	Science	55	8.14	
	Agricultural engineering	165	3.44	Mode = Agriculture
	Humanities	73	6.19	
	Other	33	9.8	
Work experience n=218 Average = 12.99	5-1	6	1.6	1.6
	6-10	75	20.2	21.8
	11-15	136	36.5	58.3
	16-20	123	33.1	91.4
	21-25	14	3.8	95.2
	26-30	15	4.8	100



164 In the structural equation model methodology, it is first necessary to study the validity of the  
 165 structure in order to determine whether the indicators selected to measure the desired structures  
 166 have the necessary accuracy. That is, have the questions to measure the variables been chosen  
 167 correctly or not? For this purpose, confirmatory factor analysis (CFA) is used. In this method, the  
 168 factor load of each indicator with its structure must be higher than 0.4. Factor loadings were  
 169 calculated by measuring the correlation between indicator and connected construct. This suggests  
 170 acceptable reliability regarding the measurement model (Table 6).

171  
 172 **Table 6.** Factor loadings under the modified components of the extension drought management  
 173 model.

Factors	Manifesting variable	Factor loading
<b>Contextual conditions</b>	The presence of weather and climate information centers	0.731
	Information capacity of agricultural service centers	0.525
	The existence of agricultural and irrigation cooperatives	0.498
	The existence of training centers in the field of drought management	0.494
	Agriculture to financial resources	0.493
	Insensitivity of people and social networks	0.802
	Unauthorized exploitation of water resources	0.462
<b>Causal conditions</b>	The government's insensitivity to the issue	0.460
	Low level of education	0.455
	Weak financial base of farmers	0.447
<b>Intervening conditions</b>	Weakness of water infrastructure	0.408
	Crop insurance coverage	0.675
	Guaranteed purchase of agricultural products	0.671
	Investing in the infrastructure of irrigation networks	0.569
	Water pricing and sale	0.536
	Granting loans and free facilities	0.448
	Effective monitoring of the license of agricultural wells	0.447
<b>dissemination variables</b>	Supporting organizations and cooperative companies in the water sector	0.424
	Considering and measuring the educational- dissemination needs of farmers	0.612
	Using radio and television agricultural programs (mass media)	0.583
	Holding educational workshops	0.569
	Using dissemination personal messengers	0.558
	Using the Internet and virtual networks	0.516
<b>Consequences</b>	Visiting new irrigation systems	0.506
	Increase in fake jobs	0.905
	Reduction of cultivated area	0.903
	Decrease in income	0.808
	Insecurity	0.795
	Increase in input prices	0.790
	Reducing the price of agricultural land	0.730
	Decrease in production	0.713
	Decreased quality of life	0.707
	Decrease in welfare	0.598
	Reduction of local communication among people	0.591
<b>Requirements for extension drought management</b>	Increase in unemployment rate and immigration	0.582
	Assessing the educational- dissemination needs of farmers	0.842
	Providing extension specialist human resources	0.652
	Reforming the organizational structures of extension	0.591
	Reforming the financial structures of extension organizations	0.462
Increasing the professional qualifications of extension agents	0.411	



174 After ensuring the existence or non-existence of a causal relationship between the research  
 175 variables and checking the appropriateness of the observed data with the conceptual model, the  
 176 research hypotheses were also tested using SEM (the PLS approach). Table 7 and 8 depict the  
 177 results of running model, and Tables 11 present the results of testing the hypotheses.

178 Table 7 shows the values of  $R^2$  that represent the explained variance. Based on this, supporting  
 179 conditions with a coefficient of 0.16 has the greatest effect and Consequences of drought with a  
 180 coefficient of 0.06 has the least effect of Drought management. The total variables have explained  
 181 0.15 of the variance of the dependent variable.

182  
 183 **Table 7.** The measurement of the main model and the results of the hypotheses in the standard  
 184 mode.

Variable	R <sup>2</sup>	Path coefficient
Drought management (the dependent variable)	0.155	-
Detailed requirements of drought management	0.00	0.013
Extensional methods of drought management	0.00	0.033
Contextual conditions	0.00	0.1011
Supporting conditions	0.00	0.166
Conditions and causes	0.00	0.102
Consequences of drought	0.00	0.065

185  
 186 The values listed in Table 8 shows the T values. For each factor to be significant, the value of  
 187 T should be significant at the error level of 0.05, that is, if its value is outside the range (1.96 and -  
 188 1.96), the effect of this component is significant. Based on the listed results, all paths are significant  
 189 (Table 8).

190  
 191 **Table 8.** The measurement of the original model and the results of the hypotheses in the standard  
 192 mode.

Variable	T values
Drought crisis management (the dependent variable)	-
Detailed requirements of drought crisis management	4.874
Extensional methods of drought crisis management	2.207
Contextual conditions	2.094
Supporting conditions	4.661
Conditions and causes	4.812
Consequences of drought	2.029

193  
 194 The table 9 shows the factor loading values to answer the question of whether the questions to  
 195 measure the variables are chosen correctly or not. To have the appropriate accuracy, the factor  
 196 loading should be higher than 0.4. Based on the results listed in Table 9, most factor loadings are  
 197 greater than 0.4.

Table 9. The measurement of the final model in the standard mode.

Variable	Sign	Factor loading	Correlation coefficient
Drought management (the dependent variable)	Critical	1.00	--
Extensional methods of drought crisis management	M1	0.498	0.560
	M2	0.569	
	M3	0.612	
	M4	0.320	
	M5	0.506	
	M6	0.516	
	M7	0.622	
	M8	0.715	
	M9	0.573	
	M10	0.396	
	M11	0.583	
	M12	0.658	
Contextual conditions	AR1	0.407	0.170
	AR2	0.525	
	AR3	0.494	
	AR4	0.731	
	AR5	0.498	
	AR6	0.557	
	AR7	0.435	
	AR8	0.677	
	AR9	0.671	
	AR10	0.438	
	AR11	0.508	
	AR12	0.493	
Supporting conditions	MD1	0.571	0.167
	MD2	0.675	
	MD3	0.424	
	MD4	0.447	
	MD5	0.669	
	MD6	0.538	
	MD7	0.448	
	MD8	0.420	
	MD9	0.497	
Causal conditions	F1	0.460	0.440
	F2	0.802	
	F3	0.447	
	F4	0.455	
	F5	0.462	
	F6	0.408	
	F7	0.505	
	F8	0.446	
	F9	0.477	
	F10	0.471	
	F11	0.461	
	F12	0.595	
	F13	0.584	
	F14	0.776	
Consequences	CH1	0.808	0.001
	CH2	0.906	
	CH3	0.591	
	CH4	0.571	
	CH5	0.795	
	CH6	0.707	

	CH7	0.490
	CH8	0.682
	CH9	0.733
	CH10	0.598
	CH11	0.713
	CH12	0.903
	CH13	0.510
	CH14	0.833
	CH15	0.742
	CH16	0.601

199  
 200 Table 10 shows the T values of the indicators used for the structures. For each indicator to be  
 201 significant, the value of t is significant at the error level of 0.05, that is, its value is outside the  
 202 range (1.96 and -1.96), and then this indicator correctly measures the desired component. Based on  
 203 the results shown in Table 10, all the indicators used are significant.

204  
 205 **Table 10.** The measurement of the final model and the results of the hypotheses in the significant  
 206 state.

Variable	Sign	T value	Correlation coefficient
Drought management (dependent variable)	Critical	1.00	--
Extensional methods of drought management	M1	3.463	2.428
	M2	3.552	
	M3	3.877	
	M4	3.285	
	M5	2.485	
	M6	2.270	
	M7	2.706	
	M8	2.592	
	M9	2.272	
	M10	2.928	
	M11	3.862	
	M12	0.588	
Contextual conditions	AR1	2.681	2.248
	AR2	2.329	
	AR3	4.399	
	AR4	2.270	
	AR5	2.168	
	AR6	3.043	
	AR7	3.359	
	AR8	2.866	
	AR9	2.678	
	AR10	2.176	
	AR11	3.327	
	AR12	2.027	
Supporting conditions	MD1	3.523	2.931
	MD2	2.329	
	MD3	3.983	
	MD4	3.399	
	MD5	2.844	
	MD6	2.206	
	MD7	3.305	
	MD8	4.597	

Causal conditions	MD9	2.346	3.719
	F1	3.038	
	F2	3.141	
	F3	2.211	
	F4	3.997	
	F5	2.010	
	F6	3.933	
	F7	2.160	
	F8	4.757	
	F9	2.960	
	F10	3.951	
	F11	2.110	
	F12	2.160	
	F13	1.035	
Consequences	F14	2.138	2.008
	CH1	4.044	
	CH2	3.634	
	CH3	3.107	
	CH4	2.760	
	CH5	3.137	
	CH6	2.682	
	CH7	2.161	
	CH8	2.935	
	CH9	2.751	
	CH10	2.557	
	CH11	3.358	
	CH12	3.747	
CH13	2.213		
CH14	4.112		
CH15	3.512		
CH16	2.811		

207  
 208 The effect of the independent variable on the dependent variables is depicted in Table 11. The  
 209 significance coefficient (t-statistic) of the output model of SEM was used to test the research  
 210 hypotheses. If the t-statistic was more than 1.96 or less than -1.96 (with a 5% error level), the  
 211 hypotheses would be confirmed, and the significant effect of the variable would be achieved. It can  
 212 also be seen in the measurement model that the factor coefficient for each variable is higher than  
 213 the value of 0.50%. Table (11) presents a summary of the results of hypothesis testing.

214 **Table 11.** A summary of hypotheses testing results.

Hypotheses	Path coefficient	Significance coefficient	Result
Main hypothesis: Drought-adapted extension requirements affect agricultural drought management.	0.113	4.874	Confirmed
The first hypothesis: Extension methods affect the management of agricultural drought.	0.550	2.428	Confirmed
The second hypothesis: Contextual conditions affect the management of agricultural drought.	0.170	2.248	Confirmed
The third hypothesis: Causal conditions affect the management of agricultural drought.	0.440	3.719	Confirmed
The fourth hypothesis: The consequences of drought affect the management of agricultural drought.	0.001	2.008	Confirmed
The fifth hypothesis: Management policies affect the management of agricultural drought.	0.167	2.931	Confirmed

215 Table (12) presents composite reliability (CR), coefficient of determination ( $R^2$ ), Cronbach's alpha,  
216 communality values, and communal reliability (AVE) for the main components of the research.

217 **Table 12.** The general model's quality criteria.

Research components	Composite reliability (CR)	Coefficient of determination ( $R^2$ )	Cronbach's alpha	Communal values (Cummunality)	Shared reliability (AVE)
Methods of extension drought management	0.76	0.58	0.84	0.49	0.43
Support policies	0.80	0.54	0.82	0.41	0.46
Contextual conditions	0.59	0.74	0.75	0.45	0.49
Causal conditions	0.71	0.83	0.88	0.31	0.54
Consequences	0.64	0.55	0.90	0.42	0.52
Background conditions	0.75	0.71	0.79	0.27	0.48
Drought management	1	--	1	1	1

218  
219 To check the model's fit in PLS, we used the global quality criterion proposed by Amato et al.  
220 (2004).

221 
$$GOF = \sqrt{communality \times R^2}$$

222 The index of fit of the general model (GOF) was 0.568%, so it can be accepted that the general  
223 model of the research has a good fit. The high fit of the model shows that this model is well  
224 explained (Table 13).

225 **Table 13.** The final model's fit

Index name	$R^2$	Communality
Methods of extension drought management	0.58	0.49
Consequences	0.63	0.52
Drought support policies	0.54	0.41
Background conditions	0.74	0.45
Causal conditions	0.83	0.31

226  
227 **Discussion and Conclusions**

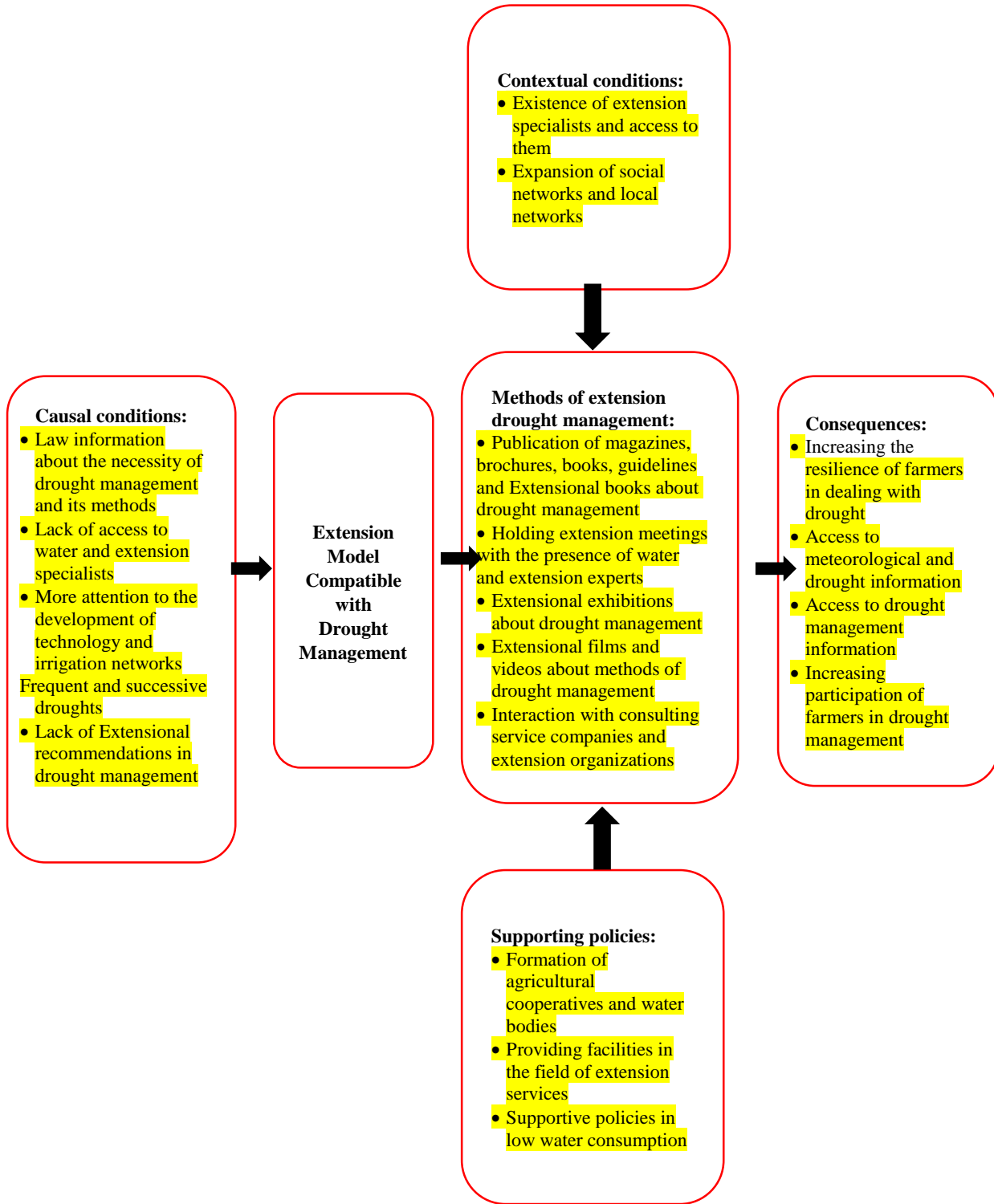
228 Agricultural sector requires specific adaptation to cope with water scarcity and drought  
229 (Yazdanpanah et al., 2015; Delphian, 2016). To address this challenge, an extension model should  
230 be designed based on local needs, culture, local language, and appropriate communication methods  
231 in each region to mitigate the negative impacts of these changes (Ifeanvi-obi et al., 2012; Engle,  
232 2011).

233 Due to the level of knowledge and low adaptation to the phenomenon of drought, developing  
234 countries are more affected by the risks associated with it than other regions (Xenarios et. al., 2016).  
235 There are many reasons for this, including the lack of access to water and extension specialists,  
236 Lack of practical solutions for drought management and Lack of Extensional recommendations in

237 drought management Also, the results of studies indicate an increase in the number of droughts in  
238 Iran (Firozi et al., 2019) In this case, there is a need for adaptation and drought management by  
239 farmers (karimi and atai, 2022) .The decision-making process around adaptation is complex  
240 (Bunham & Ma, 2016, Harmer & Rahman, 2014) and includes a wide and interconnected range of  
241 socio-political, social and environmental factors. Weather, its intensity and the level of confidence  
242 of farmers about receiving yield due to adaptation are closely related (Tucker et al., 2010; Anik et  
243 al., 2012). Therefore, it is important to extension drought management methods with the  
244 participation and cooperation of farmers. , which these methods include. People's participation in  
245 the adaptation of drought management is one of the necessary things in the success of programs in  
246 this field (Wani et al (2003). Blomley (2006) Ruiz-Malle'n et al., 2015). Publication of  
247 magazines, brochures, books, guidelines and Extensional books, about new methods of irrigation  
248 with traditional and old methods and comparing them in a demonstration for a group of farmers,  
249 Holding extension meetings with the presence of water and extension experts, Extensional  
250 exhibitions(New irrigation tools and methods) and, Extensional films and videos about new  
251 irrigation methods , Farmers visits to the office of the Agricultural Extension Service, Visit of  
252 agricultural extension workers to the farmers, Interaction with consulting service companies and  
253 extension organizations (Al-Zahrani et al., 2016 ). These activities are aimed at addressing  
254 informational and educational needs related to drought management (Harvey et al., 2014; Singh et  
255 al., 2017; Tripathi & Mishra, 2017). Such as to create these conditions need to Existence of  
256 extension specialists and access to them, Expansion of social networks and local networks to  
257 disseminate information.

258 Also Formation of agricultural cooperatives and water bodies In order to create irrigation  
259 groups, providing facilities in the field of extension services, Supportive policies in low water  
260 consumption (Cheng & Tao, 2010; Eriksen & Silva, 2009; Keshavarz & Karami, 2013). It can help  
261 a lot to establish a extension model that is compatible with the management of drought. In the end,  
262 it can be said that the establishment of this extension model can include: Increasing the resilience  
263 of farmers in dealing with drought, Access to meteorological and drought information, Access to  
264 drought management information, increasing participation of farmers in drought management.

265 (Figure 1) shows Extension Model Co  
266 mpatible with Drought Management in Iran.



**Figure 1.** The final research model of the extension model compatible with drought crisis management.

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270  
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273 **Recommendations**

274 Based on the results, it is recommended to involve knowledgeable agricultural extension experts  
275 in providing necessary training and technical advice to farmers. It will be helpful to establish  
276 constructive communication between farmers and extension agents through social networks to  
277 address existing water-related issues and convey them to relevant authorities for appropriate  
278 solutions. Also, the importance of water and the impact of water scarcity challenges on economic,  
279 social, and security sectors should be recognized. Additionally, it is necessary to prioritize this  
280 issue as a fundamental strategy in the annual budget and Iran's Seventh Development Plan. Last  
281 but not least importantly, it is recommended that the government support farmers through facilities  
282 such as low-interest loans and subsidies to assist in implementing adaptation strategies and drought  
283 management.

284

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