Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Analyzing the Persistence of Water-Intensive Cropping under Compound Climate Shocks: The Role of Psychological Capital Inversion and the Moderating Effect of Civilizational Drought on the Adoption of Alternative Cropping

Masoumeh Taghibaygi

resina2011@gmail.com

Razi University

Amirhossein Alibaygi

Razi University

Article

Keywords: Water governance, rural livelihood crisis, social responsibility, water scarcity adaptation, psychological resilience

Posted Date: November 12th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11048232/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Analyzing the Persistence of Water-Intensive Cropping under Compound Climate Shocks: The Role of Psychological Capital Inversion and the Moderating Effect of Civilizational Drought on the Adoption of Alternative Cropping

Masoumeh Taghibaygi*[1], Amirhossein Alibaygi[2]

*1. Postdoctoral Researcher of Agricultural Education, Department of Agricultural Extension and Education, Faculty of Agriculture, Razi University, Kermanshah, Iran. Corresponding Author E-mail: resina2011@gmail.com

2. Professor, Department of Agricultural Extension and Education, Faculty of Agriculture, Razi University, Kermanshah, Iran.

Abstract

Compound climate shocks have reduced global agricultural productivity and, in Iran, combined with water mismanagement, have led to "civilizational drought"; the adoption of alternative cropping remains slow despite awareness. This study aims to explain this paradox by examining the moderating role of "civilizational drought perception" in the relationship between psychological capital and the intention and behavior of adopting alternative cropping among 380 smallholder irrigated farmers in Kermanshah Province. Data were collected using a structured questionnaire and analyzed via structural equation modeling (PLS-SEM). Results showed that attitude ($\beta = 0.285$), subjective norms ($\beta = 0.224$), and perceived behavioral control ($\beta = 0.298$) had positive effects on intention. In the NAM model, awareness of consequences affected ascription of responsibility ($\beta = 0.412$), ascription of responsibility affected personal norm ($\beta = 0.456$), and personal norm affected intention ($\beta = 0.312$). Self-efficacy ($p = 0.241$) and optimism ($p = 0.215$) had no significant effect on intention, whereas hope ($\beta = 0.242$) and resilience ($\beta = 0.218$) were significant. Moderation analysis revealed that civilizational drought only reversed the relationship between self-efficacy and intention ($\beta = -0.178$, $p = 0.005$), and no significant moderating effect was observed for optimism, hope, and resilience. Findings indicated that intention had a positive effect on behavior ($\beta = 0.452$), while civilizational drought perception had a negative effect on behavior ($\beta = -0.215$). The model explained 52% of the variance in intention and 38% of the variance in behavior.By empirically confirming the inversion of self-efficacy, this study demonstrates that under civilizational drought, this component not only fails to facilitate the adoption of alternative cropping but also becomes a serious barrier by fostering excessive trust in traditional methods. The findings offer new insights into the nature of the awareness-behavior paradox in environmental crises and challenge the effectiveness of extension approaches based on individual empowerment.

Keywords: Water governance, rural livelihood crisis, social responsibility, water scarcity adaptation, psychological resilience.

Introduction

In recent decades, agricultural systems worldwide have faced an unprecedented challenge resulting from the overlap of three fundamental trends: rapid climate change, declining renewable water resources, and increasing food insecurity. The Intergovernmental Panel on Climate Change (IPCC) has warned in its latest reports that the frequency and intensity of extreme climate events, such as prolonged droughts and concurrent heatwaves, have significantly increased in semi-arid regions of the world[1]. These phenomena, known as "compound climate shocks," exert additional stress on water resources and agricultural productivity through complex feedbacks between soil dryness and surface temperature increases[2]. Empirical evidence indicates that compound drought-heat events can cause water productivity losses far exceeding the sum of the individual effects of each phenomenon, exposing agricultural systems to unprecedented vulnerability. According to a global meta-analysis, for every one degree Celsius increase in maximum temperature, crop yields decrease by an average of 4.21%, and it is projected that a 2.6°C temperature increase and approximately 35% reduction in precipitation by mid-century will impose severe economic consequences on agricultural units[3].

Among the world's vulnerable regions, the Middle East, and particularly Iran, is considered hotspots of climate-water crises. With an average annual precipitation of less than 250 mm, significantly lower than the global average, Iran is located in the arid and semi-arid belt of the world, with about 90% of its area classified as arid[4]. However, what Iran faces today goes beyond a mere meteorological drought and calls for a new concept termed "civilizational drought." This concept refers to a point at which chronic climatic pressure, structural mismanagement, demographic pressure, and infrastructure erosion converge simultaneously, jeopardizing the continuity of a society's civilizational life, such that settlement, production, public health, and governance are at risk. Evidence of this civilizational crisis in Iran is clearly visible: Lake Urmia's water level has decreased by more than 90%, over 70 billion cubic meters of the country's aquifers were depleted between 2002 and 2015, and land subsidence in some provinces exceeds 25 cm per year. More than 300 cities and 8,000 villages in Iran face water stress, and the agricultural sector, which consumes over 90% of the country's water resources with an efficiency of only 45%, is the main focus of the crisis[4]. Self-sufficiency policies based on water-intensive crop cultivation have played a key role in exacerbating this crisis, as national studies show that climate change could reduce agricultural production in irrigated systems by up to 9%[5].

Kermanshah Province in western Iran, due to its geographical location, heavy dependence of rural livelihoods on rainfed and irrigated agriculture, and exposure to recurrent climate shocks, is one of the most sensitive areas in the country to water crisis and civilizational drought. Meteorological data indicate that the province has experienced mild to very severe droughts in recent years, and trend analysis suggests a significant increase in drought at some stations. Groundwater levels in the province's plains have dropped by about 18 meters over the past 30 years, and this situation, coupled with increased water demand for agricultural and urban uses, has fueled serious competition and conflicts over water

resources in the province[5]. Research in the Deyreh Plain of Kermanshah Province shows that continued drought and reduced water access will drive cropping patterns toward low-water-demand crops, and simulations indicate that cultivating high-yield varieties such as canola, safflower, and triticale can significantly reduce drought-induced losses. Additionally, the expansion of rainfed almond cultivation on 5,500 hectares of the province's lands reflects farmers' efforts to adapt to water scarcity by replacing water-intensive crops with more resistant species[5]. However, despite the identification of alternative technical options, the adoption of alternative cropping among farmers is not progressing at the expected speed and scale, and this phenomenon requires deeper investigation into psychological and structural barriers[5].

Despite extensive research on climate change and water management in Iran, a considerable portion of studies has focused on hydrological, climatological, and economic-technical dimensions, while the role of psychological and socio-cognitive variables and psychological capital components in farmers' decision-making for adopting alternative cropping has received less attention[6]. Psychological capital, defined as a "positive and developable psychological state" comprising self-efficacy, optimism, hope, and resilience, can play a key role in how farmers perceive and respond to climate shocks[7]. However, there is a significant theoretical and empirical gap regarding the adoption of alternative cropping as a long-term adaptation strategy to civilizational drought. Under compound climate shocks and the perception of "civilizational drought" as an existential threat, psychological capital components may turn from facilitators into barriers to adopting alternative cropping; in other words, high self-efficacy may become "excessive trust in traditional methods," optimism may become "risk denial," hope may become "messianic expectation of government interventions," and resilience may become "passive tolerance of conditions"[8]. Research has shown that problem-solving and belief/value-based coping strategies can moderate the negative effects of climate change on farmers' quality of life, whereas avoidance strategies do not, underscoring the importance of examining psychological capital inversion under crisis conditions[6].

Based on the literature review, the main problem of this research can be formulated as a central question: Why, despite increasing awareness of drought risks and the availability of alternative technical solutions, is the adoption of alternative cropping among farmers slow? This study aims to investigate this phenomenon by analyzing the moderating role of civilizational drought perception in the relationship between psychological capital and the intention and behavior of adopting alternative cropping among farmers in Kermanshah Province, western Iran. It seeks to provide a comprehensive model for explaining farmers' adaptation behavior by employing an integrated approach and utilizing the theoretical frameworks of the Theory of Planned Behavior and the Norm Activation Model[9, 10]. On the one hand, this research contributes to expanding the boundaries of knowledge in environmental psychology and adaptation behaviors to climate change in rural communities; on the other hand, by identifying the psychological-social barriers to adopting alternative cropping, it provides valuable tools for designing more effective interventions in water scarcity adaptation for policymakers and agricultural planners[5]. Indeed, this study, aiming to

fill the existing gap in the scientific literature, seeks to answer the fundamental question of how compound climate shocks and the novel concept of civilizational drought are related to the inversion of farmers' psychological capital and how they affect the intention and adoption of alternative cropping. The findings of this research can, while enriching the existing literature, pave the way for designing more effective policies for water crisis management in arid and semi-arid regions of the world.

Theoretical Foundations and Research Background

Climate Change and Water Scarcity Adaptation Behavior

To explain farmers' adaptation behaviors under water scarcity and drought conditions, several theories have been proposed in the scientific literature, each analyzing the factors influencing decision-making and behavior from a different perspective. In this study, given the multidimensional nature of the phenomenon under investigation, two main theoretical frameworks have been integrated: The Theory of Planned Behavior (TPB) and the Norm Activation Model (NAM), which have been widely used in studies of environmental behaviors and climate change adaptation[9, 10]. The Theory of Planned Behavior, introduced by Ajzen[9] as an extension of the Theory of Reasoned Action, is one of the most widely applied psychological frameworks for predicting human behaviors[11]. According to this theory, behavioral intention, which is the most important predictor of performing a behavior, is influenced by three main constructs: attitude toward the behavior (the individual's positive or negative evaluation of performing the behavior), subjective norms (social pressures and expectations of reference groups), and perceived behavioral control, which refers to the individual's perception of the ease or difficulty of performing the behavior[9]. In the fields of agriculture and water resources management, numerous studies have shown that these three constructs can explain a considerable portion of the variance in farmers' intention and behavior regarding the adoption of modern irrigation technologies and alternative cropping[11, 12]. For instance, Menatizadeh et al [11] in Iran demonstrated that attitude, subjective norms, and perceived behavioral control significantly explained farmers' intention to adopt efficient irrigation systems, with climate change awareness moderating these relationships. Furthermore, Menatizadeh et al [11] in China, using the TPB framework, found that positive attitude toward water conservation and subjective norms arising from peer pressure are among the most important predictors of water-saving behavior among farmers. In a study on Chinese farmers, perceived behavioral control was identified as the strongest predictor of intention to adopt modern irrigation technologies, and this relationship was moderated by demographic variables[12]. However, the main criticism of this theory is that by focusing on individual interests and socio-cognitive factors, it is often unable to explain moral and altruistic motivations for behavior[13].

In contrast, the Norm Activation Model, developed by Schwartz[10] to explain prosocial and pro-environmental behaviors, emphasizes moral and altruistic motivations[10]. According to this model, an individual's decision to engage in environmental behaviors is influenced by three main constructs: awareness of consequences (the individual's understanding of the negative consequences of not performing an environmental behavior), ascription of

responsibility (the individual's sense of responsibility for the negative environmental consequences and acceptance of an active role in reducing them), and personal norm, which refers to the internal moral obligation to perform or refrain from a specific behavior[14]. When an individual becomes aware of the negative consequences of a behavior and feels responsible, the personal norm is activated, leading to intention and subsequently actual behavior[15]. This model has demonstrated high explanatory power, particularly in studies focusing on moral motivations in natural resource conservation and climate change adaptation. For instance, Huo et al [14]in a study on rural communities in China showed that awareness of the negative consequences of drought and ascription of responsibility are the most important predictors of personal norm and water conservation behaviors[14]. Furthermore, Menatizadeh et al [15], using the NAM in a study in rural areas of China, found that personal norm plays a key mediating role in the relationship between awareness of consequences and water conservation behaviors. Valizadeh et al [16] in Iran, in a study on farmers, found that the NAM could explain 52% of the variance in drought adaptation behaviors. However, the NAM alone also neglects self-interested and rational processes and cannot cover all dimensions of behavior[17].

Given the limitations of each of these theories in fully explaining farmers' adaptation behavior under water scarcity, contemporary research emphasizes the integration of these two theoretical frameworks[6]. The integration of TPB and NAM allows for the simultaneous consideration of socio-cognitive factors (attitude, subjective norms, and perceived behavioral control) and moral-altruistic factors (awareness of consequences, ascription of responsibility, and personal norm) in explaining environmental behaviors[17]. Such an integrated approach is particularly effective in domains where both individual interests and moral obligations play a role in decision-making, such as the adoption of alternative cropping under water scarcity[5]. Sandra et al [17] in a study in Europe, integrating TPB and NAM, showed that the integrated model could explain 67% of the variance in farmers' behavioral intention to adopt alternative cropping, with psychological capital variables playing a considerable moderating role in these relationships[17].

Based on the Theory of Planned Behavior and the Norm Activation Model, the following hypotheses can be derived:

- H1 Farmers' positive attitude toward alternative cropping has a positive and significant effect on their behavioral intention to adopt alternative cropping.

- H2 Subjective norms (social pressures and expectations of reference groups) have a positive and significant effect on farmers' behavioral intention to adopt alternative cropping.

- H3 Perceived behavioral control (the farmer's perception of the ease or difficulty of adopting alternative cropping) has a positive and significant effect on their behavioral intention to adopt alternative cropping.

- H4 Farmers' awareness of the negative consequences of continuing water-intensive cropping has a positive and significant effect on their ascription of responsibility.

- H5 Farmers' sense of responsibility for the negative consequences of water-intensive cropping has a positive and significant effect on their personal norm.

- H6 Farmers' personal norm (internal moral obligation) has a positive and significant effect on their behavioral intention to adopt alternative cropping.

Psychological Capital and Its Role in Climate Change Adaptation Behaviors

Psychological capital is defined as a "positive and developable psychological state" comprising four main components: self-efficacy (confidence in one's abilities to perform challenging tasks), optimism (positive attribution to present and future events), hope (designing alternative pathways to achieve goals), and resilience (the ability to bounce back from adversity and failure) [7]. This concept, rooted in positive psychology, has been widely considered over the past two decades in the fields of human resource management, organizational behavior, and more recently in environmental studies and climate change adaptation behaviors[6].

Numerous studies have shown that psychological capital can play a key role in how farmers perceive and respond to climate shocks and water scarcity conditions[8]. In a study on South African farmers, it was found that farmers with higher psychological capital showed a greater tendency to adopt climate change adaptation strategies, and this relationship was explained through increased self-efficacy and hope[6]. In other words, farmers who trust in their abilities to cope with challenges and are optimistic about the future are more likely to try and apply new strategies[8]. In a study on small-scale farmers in South Africa, they showed that self-efficacy and psychological resilience are the most important predictors of adopting modern agricultural technologies under water scarcity conditions.

Regarding farmers' job satisfaction, research has shown that self-efficacy, resilience, and optimism can explain 41% of the variance in job satisfaction, confirming the vital role of psychological capital in farmers' performance and well-being[6]. Furthermore, research has shown that problem-solving and belief/value-based coping strategies can moderate the negative effects of climate change on farmers' quality of life, whereas avoidance strategies do not; this finding reveals the importance of examining not only the level of psychological capital but also how it is utilized under crisis conditions[6].

Based on the presented material, the hypotheses of this section of the study are as follows:

- H7 Farmers' self-efficacy has a positive and significant effect on their behavioral intention to adopt alternative cropping.

- H8 Farmers' optimism has a positive and significant effect on their behavioral intention to adopt alternative cropping.

- H9 Farmers' hope has a positive and significant effect on their behavioral intention to adopt alternative cropping.

- H10 Farmers' resilience has a positive and significant effect on their behavioral intention to adopt alternative cropping.

Psychological Capital Inversion

The concept of "psychological capital inversion" refers to a situation in which the components of psychological capital, instead of facilitating adaptive behaviors, become barriers to adopting new strategies[4]. This phenomenon, which has been examined in limited research, is more likely to occur under crisis conditions and when threats are perceived as "existential" and "beyond individual control"[8]. Anderson et al[3] in a global meta-analysis showed that perceiving climate threats as "existential" threats can lead to passivity and decision paralysis instead of facilitating adaptive behaviors.

Under compound climate shocks and the perception of "civilizational drought" as a pervasive and civilizational threat, high self-efficacy may turn into "excessive trust in traditional methods," preventing the farmer from testing new solutions[4]. Optimism may also turn into "risk denial," such that the farmer ignores the severity and seriousness of the threat and lacks motivation for preventive action[3]. Hope may turn into "messianic expectation of government interventions," in which the farmer, instead of taking personal action, waits for the problem to be solved by external institutions[5]. Resilience may also turn into "passive tolerance of conditions," in which the farmer, instead of changing conditions, adapts to and tolerates the existing situation[6]. This phenomenon, called "inversion," can explain the apparent paradox between increasing awareness of drought risks and the slow adoption of alternative cropping[5]. In other words, farmers with high levels of psychological capital may, under conditions of perceived civilizational threat, insist on their traditional methods instead of adopting new strategies[4].

Accordingly, the hypothesis of this section of the study is as follows:

- H11 Under high civilizational drought perception, the relationship between psychological capital and behavioral intention to adopt alternative cropping changes such that the components of psychological capital (self-efficacy, optimism, hope, and resilience), instead of facilitating, hinder the intention to adopt alternative cropping; in other words, civilizational drought plays a reversing moderating role in the relationship between psychological capital and behavioral intention to adopt alternative cropping[3,4].

Civilizational Drought

The concept of "civilizational drought" refers to a point at which chronic climatic pressure, structural mismanagement, demographic pressure, and infrastructure erosion converge simultaneously, jeopardizing the continuity of a society's civilizational life. This concept goes beyond mere meteorological or hydrological drought and encompasses economic, social, cultural, and political dimensions[5]. In other words, when the continuity of settlement, production, public health, and governance is at risk, one can speak of civilizational drought[4].

In Iran, evidence of this civilizational crisis is clearly visible: Lake Urmia's water level has decreased by more than 90%, over 70 billion cubic meters of the country's aquifers were depleted between 2002 and 2015, and land subsidence in some provinces exceeds 25 cm per year. More than 300 cities and 8,000 villages in Iran face water stress, and the agricultural

sector, which consumes over 90% of the country's water resources with an efficiency of only 45%, is the main focus of the crisis[4]. Self-sufficiency policies based on water-intensive crop cultivation have played a key role in exacerbating this crisis, and national studies show that climate change could reduce agricultural production in irrigated systems by up to 9%[5].

The perception of civilizational drought as an existential threat can have profound effects on farmers' decision-making processes. In situations where farmers feel they are facing a pervasive and uncontrollable threat, they may experience a kind of "decision paralysis," in which, instead of taking active action, they become passive and wait for external interventions[3]. This phenomenon can explain the paradox between increasing awareness of drought risks and the slow adoption of alternative technical solutions. Moridi et al[5] in a study in Kermanshah Province showed that despite the identification of alternative technical options, psychological and socio-cognitive factors play a more determining role in the adoption of alternative cropping, revealing the need for more comprehensive theoretical models. Moradi et al [5], in a study on farmers in Kermanshah, also examined different dimensions of drought and its impact on farmers' adaptation behaviors and showed that the perception of this phenomenon can lead to reduced self-efficacy and increased passivity.

Based on the presented material, the hypotheses of this section of the study are as follows:

- H12 Civilizational drought perception has a negative and significant effect on farmers' behavioral intention to adopt alternative cropping.

- H13 Behavioral intention to adopt alternative cropping has a positive and significant effect on the actual adoption of alternative cropping (behavior).

- H14 Civilizational drought perception has a negative and significant effect on the actual adoption of alternative cropping (behavior).

A systematic review of the research literature reveals considerable gaps in existing knowledge that this study seeks to fill. First, despite numerous studies on climate change adaptation and water scarcity behaviors, most studies have focused on hydrological, climatological, and economic-technical dimensions, and the role of psychological and socio-cognitive variables, particularly the novel concept of "psychological capital inversion," has received less attention. Furthermore, despite the introduction of the concept of "civilizational drought" in recent years, few empirical studies have examined the moderating role of this concept in the relationships between psychological variables and adaptation behaviors[4]. Additionally, integrated studies that simultaneously use the TPB and NAM frameworks as well as the concept of psychological capital to explain the adoption of alternative cropping are scarce in the scientific literature[17]. Finally, despite numerous studies on water management in Iran, a limited number of them have specifically analyzed the psychological-social factors affecting the adoption of alternative cropping among farmers in Kermanshah Province[5]. The main innovation of this study lies in presenting a comprehensive and integrated model that simultaneously considers the role of socio-cognitive variables (derived from TPB), moral-altruistic variables (derived from NAM), and psychological capital components in explaining the intention and actual adoption of alternative cropping, and

examines the moderating role of "civilizational drought perception" as a variable that can cause "inversion" in the relationship between psychological capital and the intention to adopt alternative cropping.

Conceptual Framework of the Study

Based on the theoretical foundations and research background, the conceptual framework of this study is presented in Figure 1, showing the relationships between the main constructs and the research hypotheses. This framework consists of three main categories of variables: socio-cognitive variables derived from the Theory of Planned Behavior (attitude, subjective norms, and perceived behavioral control), moral-altruistic variables derived from the Norm Activation Model (awareness of consequences, ascription of responsibility, and personal norm), and psychological capital components (self-efficacy, optimism, hope, and resilience). The variable "civilizational drought perception" is considered as a moderating variable that moderates the relationship between psychological capital and behavioral intention to adopt alternative cropping. Furthermore, behavioral intention serves as a mediating variable between the independent variables and the actual adoption of alternative cropping (behavior). The psychological capital inversion hypothesis (H11) under high civilizational drought perception is depicted such that the direction of the relationship between psychological capital and behavioral intention to adopt alternative cropping is reversed.

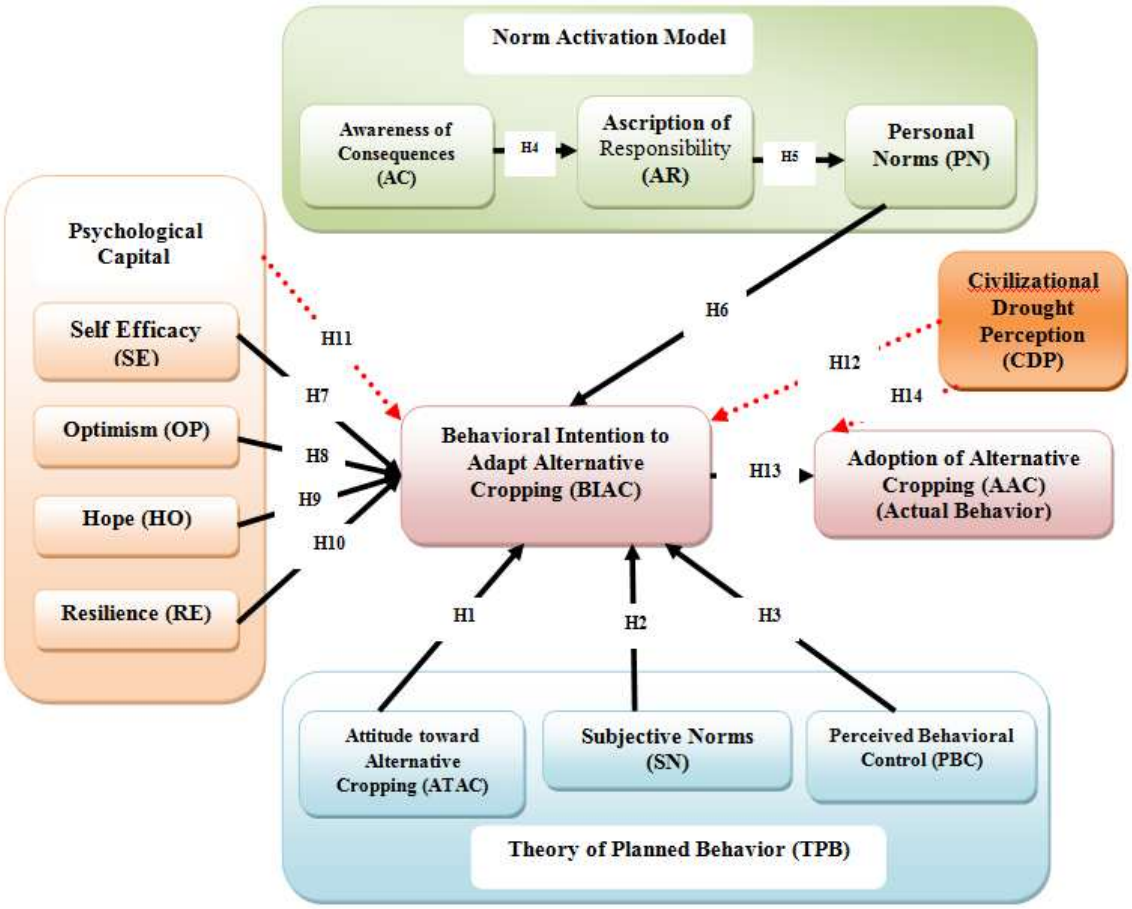


Figure.1. Conceptual Framework of the Research

Research Methodology

Study Area

The present study was conducted in Kermanshah Province, located in western Iran and adjacent to the Iraqi border (Figure 2). Kermanshah Province, with an area of over 24,998 square kilometers, is the seventeenth largest province in the country. With approximately 711,000 hectares of rainfed land and considerable irrigated land, this province plays a key role in the production of wheat, barley, and other strategic crops, and agriculture is the main source of livelihood for most rural residents of the province[18]. However, recurrent droughts in recent years have seriously affected agricultural production, and the decline in groundwater levels in the province's plains has created serious challenges for irrigated farmers. Therefore, selecting Kermanshah as the study area provides the opportunity to objectively examine the phenomenon of "psychological capital inversion" in the context of compound climate shocks and the moderating role of civilizational drought perception in the process of adopting alternative cropping. Severe water stress, dependence of livelihoods on irrigated cultivation, and the noticeable increase in drought in this province have made it a suitable context for studying these complex relationships[5].

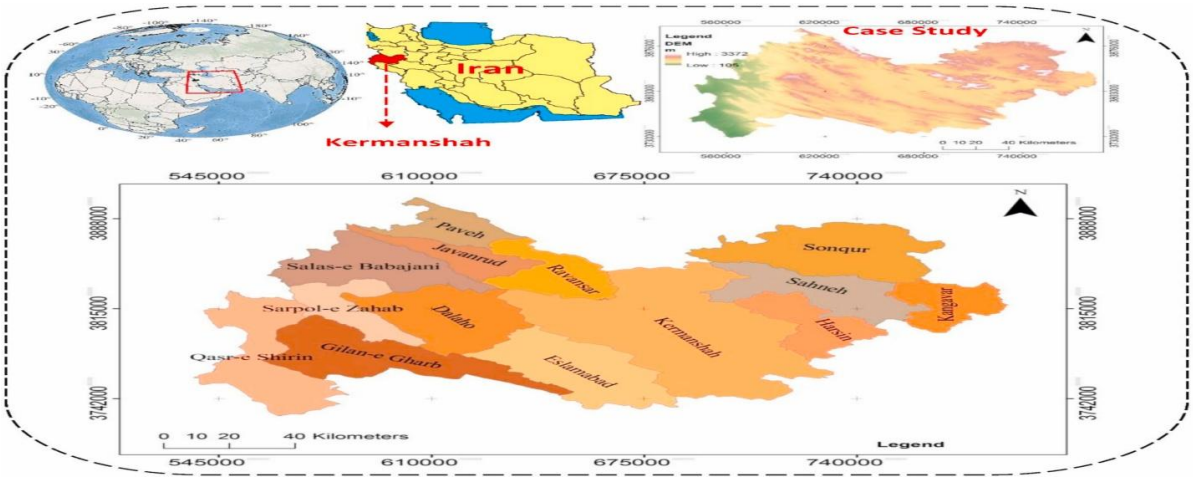


Figure.2. Geographic Location of the Study Area (Kermanshah Province, Iran)

Statistical Population and Sampling Method

The statistical population of this descriptive-correlational study consisted of all smallholder irrigated farmers (with less than 4 hectares of irrigated land) in Kermanshah Province, whose livelihoods depend primarily on irrigated cultivation and who directly use surface and groundwater resources for irrigation. The selection of smallholder irrigated farmers as the statistical population was made for the following reasons: (1) According to the Sustainable Livelihoods Framework (SLF), irrigated farmers are directly involved with natural capital (water), physical capital (irrigation infrastructure), human capital (water management skills), social capital (Water User Associations), and financial capital (investment in irrigation), and

therefore all dimensions of water governance are tangible and measurable for them[19,20]; (2) According to the law passed in 2007 in Iran, farmers with less than 4 hectares of irrigated land are recognized as smallholders and, from an agricultural policy perspective, are considered a distinct and vulnerable demographic group[21]; (3) Credible studies in Iran have used this same threshold to define smallholders[5]; and (4) smallholder farmers, given their limited financial resources, not only have little capacity to adopt modern irrigation technologies and invest in this area, but also lack sufficient influence and power to interact with decision-making institutions at the macro level. These conditions have made them the most sensitive and fragile group of beneficiaries against any mismanagement or lack of planning in the water management system[22].

According to data from the Kermanshah Province Agricultural Jihad Organization[23], the total number of smallholder irrigated farmer households in the province was estimated at approximately 32,000. To determine the sample size, Cochran's formula was used with a 95% confidence level and a 5% acceptable error, which recommended a sample size of 380 for a population of 32,000 [24]. A multistage stratified random sampling method was used to select participants. This approach was chosen to ensure adequate representation of diverse geographical and agricultural conditions across the province[25]. The sampling method consisted of four distinct stages: (1) From five geographical regions of the province (north, south, east, west, and center), two counties were randomly selected from each region, resulting in a total of ten counties; (2) From each selected county, one district was randomly selected; (3) From each selected district, two villages were randomly selected, resulting in a total of twenty villages; (4) In each village, farmers were randomly selected in proportion to the population of smallholder irrigated farmers in that village[26].

Data were collected through face-to-face interviews using a structured questionnaire administered by trained interviewers. Prior to data collection, the research team confirmed that all selected participants met the criteria for smallholder irrigated farmers (having less than 4 hectares of irrigated agricultural land and engaging in irrigated cultivation systems) [21].

Research Instrument

The primary data collection instrument was a structured questionnaire specifically designed for this study. This instrument was developed based on an extensive review of the research literature and valid scales from previous studies[4, 7, 9, 10]. The questionnaire was organized into six distinct sections:

Section One: Demographic and Agricultural Characteristics of Respondent

This section included questions about gender, age, education level, farming experience, type of land tenure (owner, tenant, shared), irrigated land area (hectares), dominant crop types cultivated, main water source (private well, shared well, river, qanat, and dam), main income source, participation in water-related extension courses, membership in Water User Associations, and level of awareness of climate change[21, 22] .

Section Two: Theory of Planned Behavior (TPB) Constructs

This section included three constructs: attitude toward alternative cropping, subjective norms, and perceived behavioral control, each with 5 items (Table 5). The attitude items focused on the farmer's positive or negative evaluation of alternative cropping, the subjective norms items focused on social pressure and expectations of reference groups, and the perceived behavioral control items focused on the farmer's perception of the ease or difficulty of adopting alternative cropping[9, 11,12].

Section Three: Norm Activation Model (NAM) Constructs

This section included three constructs: awareness of consequences, ascription of responsibility, and personal norm, each with 5 items (Table 5). The awareness of consequences items focused on the farmer's understanding of the negative consequences of continuing water-intensive cropping, the ascription of responsibility items focused on the farmer's sense of responsibility for these consequences, and the personal norm items focused on the internal moral obligation to adopt alternative cropping[10, 14, 15].

Section Four: Psychological Capital Constructs

The psychological capital constructs included self-efficacy, optimism, hope, and resilience, each with 5 items (Table 5). The self-efficacy items focused on the farmer's confidence in their abilities to perform challenging tasks, the optimism items focused on positive attribution to present and future events, the hope items focused on designing alternative pathways to achieve goals, and the resilience items focused on the ability to bounce back from adversity and failure.

Section Five: Civilizational Drought Perception (8 items)

This construct, as a moderating variable, was designed based on four components of civilizational drought: chronic climatic pressure, structural mismanagement, demographic-environmental inequality, and infrastructure erosion (Table 5). The items of this construct measure farmers' perception of various dimensions of the civilizational crisis[4, 5].

Section Six: Behavioral Intention and Adoption of Alternative Cropping

- Behavioral intention to adopt alternative cropping (5 items): This construct measures the farmer's willingness and planning to adopt alternative cropping in the future[9, 17].

- Adoption of alternative cropping (actual behavior) (5 items): This construct measures the farmer's actual behavior in replacing water-intensive crops with low-water-demand crops in the past and present[5].

All items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). To ensure cultural and linguistic appropriateness of the items, the initial version of the questionnaire was provided to five farmers to identify and correct any ambiguities or comprehension difficulties.

Statement: All interviewees were informed about data protection issues by the enumerators and gave their consent orally at the beginning of each interview. Informed consent was

obtained from all individual participants included in the study. All materials and methods were performed in accordance with the instructions and regulations and this research has been approved by a committee at College of Agriculture & Natural Resources, Razi University, and Kermanshah, Iran. All procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Validity and Reliability of the Research Instrument

To ensure content validity, the initial version of the questionnaire was reviewed by a panel of ten experts in the fields of agricultural extension, water resources management, rural development, rural sociology, and agricultural economics. The experts were asked to evaluate the clarity, relevance, and comprehensiveness of each item, as well as the overall coherence of the instrument. They assessed whether each item adequately represented its corresponding construct and whether the items collectively covered the intended dimensions. Based on their feedback, ambiguous or redundant items were revised or removed, and the final version of the questionnaire was confirmed.

Ethics Statement

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki and the national regulations governing research in Iran. In accordance with the Ethical Guidelines, Regulations, and Instructions for Biomedical Research in Iran (Secretariat of the National Committee for Ethics in Biomedical Research, Deputy of Research and Technology, Iran Ministry of Health and Medical Education, 2022), anonymous, non-interventional studies based on self-administered questionnaires which involve no physical, psychological, or biomedical intervention and pose no more than minimal risk to participants are classified as exempt from mandatory review by an institutional Research Ethics Committee, provided that participation is voluntary, informed consent is obtained, and participant anonymity and confidentiality are fully protected. The present study satisfies all of these exemption criteria: participation was entirely voluntary, no personally identifying information was collected, all responses were anonymized at the point of collection, and participants were informed of the study's purpose and their right to withdraw at any time prior to providing consent. Accordingly, and consistent with the national guidelines cited above, the study did not require submission for formal ethics committee approval.

Expert Panel Informed Consent

A panel of ten academic experts specializing in agricultural extension, water resources management, rural development, rural sociology, and agricultural economics was involved in assessing the content validity of the questionnaire. All experts were fully informed about the purpose of the study, the nature of their involvement, and the intended use of their feedback. They provided oral informed consent prior to their participation. Participation was

entirely voluntary. No personal or sensitive data were collected from the experts. Their role was limited to evaluating the clarity, relevance, and comprehensiveness of the questionnaire items, and their feedback was used solely for improving the research instrument. This separate informed consent process was conducted in accordance with the ethical principles of the 1964 Helsinki Declaration and its later amendments.

A pilot study with 35 farmers selected from a county not included in the main sample was conducted to assess face validity, clarity, and cultural appropriateness of the items. Following the pilot study, minor adjustments were made to the wording to enhance comprehension and ensure cultural and contextual appropriateness of the items for the target population. Data from the pilot study were not included in the final analysis.

Reliability was assessed using Cronbach's alpha coefficient and composite reliability (CR) [27, 28]. Cronbach's alpha values for all constructs ranged from 0.83 to 0.88, exceeding the acceptable threshold of 0.70 recommended by Nunnally and Bernstein. Composite reliability values ranged from 0.88 to 0.91, confirming the internal consistency of the measurement scales[29] (Table 5).

Convergent validity was assessed using the average variance extracted (AVE) [28]. AVE values for all latent variables exceeded the recommended threshold of 0.50 and ranged from 0.56 to 0.61, indicating acceptable convergent validity[25]. Standardized factor loadings (λ) for all indicators exceeded the recommended threshold of 0.50, ranging from 0.55 to 0.89, all of which were significant at $p < 0.001$[25]. (Table 5)

Discriminant validity was assessed using two criteria: The Fornell-Larcker[28] criterion and the HTMT ratio. According to the Fornell-Larcker criterion, the square root of AVE for each construct was greater than the correlations between that construct and other constructs, indicating acceptable discriminant validity[28]. (Table 6) Furthermore, all HTMT values were below the conservative threshold of 0.85, indicating acceptable discriminant validity for all pairs of constructs[30] (Table 7).

Confirmatory factor analysis (CFA) was performed as part of the measurement model assessment in SmartPLS 4[31]. Standardized factor loadings (λ) for all indicators exceeded the recommended threshold of 0.50[25]. (Table 5) The measurement model demonstrated good fit with the data (SRMR = 0.068, NFI = 0.91, RMS-theta = 0.079), indicating a reasonable representation of the hypothesized factor structure from the observed correlations among the measured items[32] (Table 4).

Data Analysis

Data analysis was conducted at both descriptive and inferential levels using SPSS version 27 and SmartPLS version 4[31, 33]. Descriptive analysis included frequencies, percentages, means, and standard deviations to summarize the demographic characteristics of respondents and the current status of observed variables[34].

To test the research hypotheses and evaluate the conceptual model, structural equation modeling (SEM) was employed using SmartPLS 4[25, 31]. The analysis followed the two-step

approach recommended by Hair et al [25]: (1) assessment of the measurement model and (2) assessment of the structural model. To test the significance of the hypothesized relationships, the bootstrapping method with 5,000 subsamples was used[25, 35].

Prior to testing the structural model, collinearity and common method bias were assessed. For common method bias, the full collinearity VIF approach proposed by Kock[36] was used. All VIF values ranged from 1.42 to 1.92 (Table 3), which is well below the recommended threshold of 3.3, confirming the absence of severe common method bias.

For mediation analysis, the indirect effect was tested using the bootstrapping method[35]. The significance of the indirect effect was assessed by examining 95% bias-corrected confidence intervals of the indirect path. Mediation was considered significant if the confidence interval for the indirect effect did not include zero[35].

To evaluate the predictive power of the model, the Stone-Geisser Q^2 criterion was used through the blindfolding method[37, 38] Q^2 values greater than zero indicate the predictive relevance of the model[39]. For further evaluation of predictive power, the PLSpredict criterion was used[40].

Research Findings

Descriptive findings regarding the demographic and agricultural characteristics of the 380 smallholder irrigated farmers participating in the study show that 281 (73.95%) were male and 99 (26.05%) were female. In terms of age distribution, 105 (27.63%) were under 40 years, 176 (46.32%) were between 40 and 59 years, and 99 (26.05%) were over 59 years. Regarding education level, 94 (24.74%) were illiterate, 66 (17.37%) had elementary education, 135 (35.53%) had middle and high school education, and 85 (22.37%) had university education. In terms of farming experience, 103 (27.11%) had less than 10 years, 167 (43.95%) had between 10 and 25 years, and 110 (28.95%) had more than 25 years of experience.

In terms of dominant crop types cultivated, 160 (42.11%) cultivated irrigated wheat, 109 (28.68%) irrigated barley, 58 (15.26%) corn, and 53 (13.95%) other crops (alfalfa, sugar beet). Regarding the main water source, 186 (48.95%) used private wells, 108 (28.42%) shared wells, 50 (13.16%) rivers, and 36 (9.47%) qanats and dams. Land tenure type included 205 (53.95%) owners, 105 (27.63%) tenants, and 70 (18.42%) shared. Agriculture was the sole source of income for 252 (66.32%), and 200 (52.63%) had participated in water-related extension courses. Additionally, 160 (42.11%) were members of Water User Associations. The level of climate change awareness, measured on a five-point Likert scale, showed that 43 (11.32%) had very low awareness, 59 (15.53%) low, 136 (35.79%) moderate, 81 (21.32%) high, and 61 (16.05%) very high awareness.

Variable	Category	Frequency (n=380)	Percentage (%)
Gender	Female	99	26.0
	Male	281	73.9

Age (years)	Less than 40	105	27.6
	Between 40–59	176	46.3
	More than 59	99	26.0
Education	Illiterate	94	24.7
	Elementary	66	17.3
	Secondary (Middle and High School)	135	35.5
	University	85	22.3
Farming Experience (years)	Less than 10	103	27.1
	Between 10–25	167	43.9
	More than 25	110	28.9
Dominant crop types cultivated:	Irrigated wheat	160	42.1
	Irrigated barley	109	28.6
	Corn	58	15.2
	Other (alfalfa, sugar beet)	53	13.9
Main water source	Private well	186	48.9
	Shared well	108	28.4
	River	50	13.1
	Qanat and dam	36	9.4
Type of land tenure:	Owner	205	53.9
	Tenant	105	27.6
	Shared	70	18.4
Main Income Source	Only agriculture	252	66.3
	Agriculture+ non-agriculture	80	21.0
	Non- agriculture	48	12.6
Participation in water-related extension courses	Yes	200	52.6
	No	180	47.3
Membership in Water User Associations	Yes	160	42.1
	No	220	57.8
Level of awareness of climate change	Very low	43	11.3
	Low	59	15.5
	Moderate	136	35.7
	High	81	21.3
	Very high	61	16.0

Table 1. Demographic Characteristics of Farmers (n = 380)

As presented in Table 2, the mean scores of the main research constructs show that personal norms (3.92) and ascription of responsibility (3.88) have the highest means, indicating farmers' strong moral commitment and sense of responsibility toward water resources. Among the psychological capital components, hope (3.85) and resilience (3.79) have the highest means. The lowest means belong to the adoption of alternative cropping (3.22) and behavioral intention (3.35), indicating the relative weakness of farmers' intention and behavior regarding the adoption of alternative cropping. However, the gap between intention (3.35) and behavior (3.22) suggests that even farmers with a relatively moderate intention to adopt face barriers in translating this intention into actual behavior. The mean of civilizational drought perception (3.68) is close to the theoretical mean, indicating a moderate to relatively high perception of this phenomenon among farmers.

Variable	Mean (out of 5)	Standard Deviation
Attitude toward Alternative Cropping (ATAC)	3.68	0.83
Subjective Norms (SN)	3.54	0.87
Perceived Behavioral Control (PBC)	3.42	0.90
Awareness of Consequences (AC)	3.76	0.81
Ascription of Responsibility (AR)	3.88	0.76
Personal Norms (PN)	3.92	0.79
Self- Efficacy (SE)	3.75	0.84
Optimism (OP)	3.62	0.86
Hope (HO)	3.85	0.78
Resilience (RE)	3.79	0.82
Civilizational Drought Perception (CDP)	3.68	0.88
Behavioral Intention to Adapt Alternative Cropping (BIAC)	3.35	0.94
Adoption of Alternative Cropping (AAC) (Actual Behavior)	3.22	0.96

Table 2. Descriptive Statistics of the Main Research Constructs

Assessment of Methodological Bias and Collinearity

Prior to testing the structural model, collinearity and common method bias were assessed using the full collinearity VIF approach proposed by Kock[36]. As shown in Table 3, all VIF values ranged from 1.42 to 1.92, which are well below the threshold of 3.3, confirming the absence of severe common method bias[36]. Tolerance values also ranged from 0.52 to 0.70, exceeding the threshold of 0.20, indicating the absence of collinearity[39].

Tolerance	VIF	Constructs
Attitude toward Alternative Cropping (ATAC)	1.56	0.64
Subjective Norms (SN)	1.62	0.62
Perceived Behavioral Control (PBC)	1.70	0.59
Awareness of Consequences (AC)	1.48	0.68
Ascription of Responsibility (AR)	1.52	0.66
Personal Norms (PN)	1.58	0.63
Self Efficacy (SE)	1.42	0.70
Optimism (OP)	1.66	0.60
Hope (HO)	1.54	0.65
Resilience (RE)	1.60	0.62
Civilizational Drought Perception (CDP)	1.55	0.65
Behavioral Intention to Adapt Alternative Cropping (BIAC)	1.80	0.56
Adoption of Alternative Cropping (AAC) (Actual Behavior)	1.92	0.52

Table 3. Common method bias and multicollinearity assessment (Full collinearity VIF)

Assessment of the Measurement Model

Confirmatory factor analysis (CFA) was performed to assess the validity and reliability of the constructs. The fit indices of the measurement model are presented in Table 4. The SRMR value was 0.068, NFI was 0.91, and RMS-theta was 0.079, all of which are within acceptable ranges, indicating good model fit[32].

Fit index	SRMR	D_ULS	D-G	NFI	RMS-theta
Suggested value	< 0.10	> 0.05	> 0.05	> 0.90	≤ 0.12
Estimated value	0.068	0.40	0.37	0.91	0.079

Table 4. Summary of goodness of fit indices for the measurement model

The results of Table 5 show that the standardized factor loadings (λ) for all items were above 0.50 and significant at the level of $p < 0.001$. Cronbach's alpha values for all constructs ranged from 0.83 to 0.88, exceeding the threshold of 0.70. Composite reliability (CR) values ranged from 0.88 to 0.91, rho_A values ranged from 0.85 to 0.90, and AVE values ranged from 0.56 to 0.61, all of which confirm acceptable convergent validity and internal consistency[28, 29, 39]

Constructs and Items	λ	t	Cronbach's alpha	CR	rho_A	AVE	References
Attitude toward Alternative Cropping (ATAC)[9,11, 41, 42]			0.85	0.89	0.87	0.58	
Adopting alternative cropping with low-water-demand crops is desirable to me (ATAC1)	0.818	17.906					
Changing the cropping pattern toward low-water-demand crops has economic benefits (ATAC2)	0.785	11.721					
Cultivating low-water-demand crops is compatible with environmental conservation principles (ATAC3)	0.832	14.659					
I consider alternative cropping an effective solution to combat water scarcity(ATAC4)	0.764	11.696					
Adopting alternative cropping is essential for the future of agriculture in the region (ATAC5)	0.754	10.002					
Subjective Norms (SN)[9, 11,21, 43]			0.83	0.88	0.86	0.56	
People who are important to me expect me to adopt alternative cropping (SN1)	0.859	23.940					
Other farmers in the region encourage me to adopt alternative cropping(SN2)	0.814	14.987					
Agricultural experts recommend that I switch to low-water-demand crops(SN3)	0.821	14.309					
My family supports my decision to change the cropping pattern(SN4)	0.719	9.810					
Local institutions support farmers who adopt alternative cropping (SN5)	0.581	5.005					
Perceived Behavioral Control (PBC)[9,12,41, 44]			0.84	0.88	0.85	0.57	
I have the necessary technical ability to cultivate alternative crops(PBC1)	0.586	3.586					
My access to inputs and equipment required for alternative cropping is	0.783	11.551					

easy(PBC2)							
I can cope with the costs of changing the cropping pattern(PBC3)	0.636	5.289					
The decision to change the cropping pattern is entirely within my control(PBC4)	0.790	14.855					
I can handle the problems facing alternative cropping (PBC5)	0.819	15.339					

Table 5. Results of confirmatory factor analysis for the measurement model

Constructs and Items	**ƛ**	**t**	**Cronbach's alpha**	**CR**	**rho_A**	**AVE**	**References**
Perceived Behavioral Control (PBC)[9,12,41, 44]			0.84	0.88	0.85	0.57	
I have the necessary technical ability to cultivate alternative crops(PBC1)	0.586	3.586					
My access to inputs and equipment required for alternative cropping is easy(PBC2)	0.783	11.551					
I can cope with the costs of changing the cropping pattern(PBC3)	0.636	5.289					
The decision to change the cropping pattern is entirely within my control(PBC4)	0.790	14.855					
I can handle the problems facing alternative cropping (PBC5)	0.819	15.339					
Awareness of Consequences (AC)[10,14,21,46]			**0.86**	**0.90**	**0.88**	**0.59**	
Continuing water-intensive cropping causes a severe reduction in groundwater resources(AC1)	0.658	5.270					
Water-intensive cropping leads to soil and environmental degradation(AC2)	0.840	19.358					
Continuing the current cropping trend endangers the livelihoods of future generations(AC3)	0.651	4.971					
Water-intensive cropping increases production costs in the long term(AC4)	0.676	5.125					
The reduction of water resources caused by water-intensive cropping threatens the region's food security(AC5)	0.687	5.821					
Ascription of Responsibility (AR)[10,15,21,46]			0.85	0.89	0.87	0.58	
I consider myself responsible for the negative consequences of water-intensive cropping(AR1)	0.824	15.106					
Every farmer should take action to reduce the negative effects of water-intensive cropping(AR2)	0.821	16.299					
I feel responsible for reducing water consumption on my farm(AR3)	0.831	16.023					

I feel a personal duty to protect water resources for future generations (AR4)	0.672	6.590					
My decisions regarding the cropping pattern affect the region's water resources(AR5)	0.715	8.001					

Table 5. (Continued).

Constructs and Items	λ	t	Cronbach's alpha	CR	rho_A	AVE	References
Personal Norms (PN)[10,13, 43]			0.87	0.90	0.89	0.60	
I am morally obliged to adopt alternative cropping(PN1)	0.888	35.886					
I feel guilty if I continue water-intensive cropping despite the water crisis(PN2)	0.554	4.429					
My moral commitment to environmental protection drives me toward alternative cropping(PN3)	0.890	31.688					
I hold myself obligated to observe ethical principles in water use(PN4)	0.700	5.390					
Adopting alternative cropping is consistent with my moral values(PN5)	0.576	4.513					
Self-Efficacy (SE)[5,7,8, 22]			0.88	0.91	0.90	0.61	
I have the ability to change the cropping pattern in the face of drought(SE1)	0.675	6.656					
I can implement modern irrigation methods on my farm(SE2)	0.852	22.747					
I am confident in my ability to successfully manage the farm under water scarcity conditions(SE3)	0.638	4.262					
I can reduce the effects of drought using modern methods(SE4)	0.733	9.647					
I have been successful in implementing drought adaptation strategies(SE5)	0.801	17.138					
Optimism (OP)[6,7,8,47]			0.84	0.88	0.86	0.57	
I am optimistic about the future of agriculture in the region(OP1)	0.666	5.327					
I believe that by adopting alternative cropping, I will have a better situation(OP2)	0.623	5.922					
I expect my efforts to change the cropping pattern to yield positive results(OP3)	0.728	5.815					
The future of agriculture in the region is bright despite the challenges(OP4)	0.719	6.939					
I am optimistic about the improvement of conditions in the long term(OP5)	0.746	8.174					
Hope (HO)[6,7,8]			0.86	0.89	0.88	0.59	
I have various ways in mind to adapt to water scarcity conditions(HO1)	0.839	17.949					
If a new cropping method does not work, I will try another alternative method(HO2)	0.735	9.606					
I have long-term plans to achieve a sustainable cropping pattern(HO3)	0.792	14.568					
I can find creative solutions to combat water scarcity(HO4)	0.740	10.427					
I am hopeful about my ability to find new paths	0.667	5.944					

for agriculture(HO5)							

Table 5. (Continued).

Constructs and Items	λ	t	Cronbach's alpha	CR	rho_A	AVE	References
Resilience (RE)[7,8,22, 48]			0.85	0.89	0.87	0.58	
I do not easily become discouraged by agricultural failures(RE1)	0.611	3.797					
After every failure, I try again to find a better way(RE2)	0.765	10.420					
I can adapt to harsh water scarcity conditions(RE3)	0.700	6.576					
I maintain my composure in the face of the water crisis(RE4)	0.805	11.250					
I use past experiences to cope with future challenges(RE5)	0.797	15.669					
Civilizational Drought Perception (CDP)[4, 5]			0.88	0.91	0.90	0.60	
The decrease in rainfall in recent years has seriously threatened agriculture in the region(CDP1)	0.776	14.529					
Water shortage caused by improper management has endangered the agricultural livelihood of the region(CDP2)	0.727	8.809					
Water distribution in the region is not carried out fairly(CDP3)	0.810	13.120					
The region's water infrastructure is severely worn out and inefficient(CDP4)	0.773	12.343					
The increase in temperature and decrease in rainfall have severely reduced crop yields(CDP5)	0.778	11.661					
Wrong decisions by water managers have intensified the crisis(CDP6)	0.572	4.421					
Population growth and competition over water have made the region's situation more critical(CDP7)	0.561	4.798					
The region's irrigation and drainage networks need fundamental reconstruction(CDP8)	0.677	9.561					
Behavioral Intention to Adapt Alternative Cropping (BIAC)[9, 17, 41, 42]			0.87	0.90	0.89	0.60	
I intend to allocate at least part of my land to low-water-demand crops next season(BIAC1)	0.752	9.658					
If the necessary support exists, I will definitely change my cropping pattern(BIAC2)	0.624	5.580					
I have planned to reduce the cultivation of water-intensive crops(BIAC3)	0.653	7.568					
I am willing to expand alternative cropping on my farm in the coming years(BIAC4)	0.853	11.257					
I have decided to change my cropping pattern toward low-water-demand crops(BIAC5)	0.671	9.217					
Adoption of Alternative Cropping (AAC) (Actual Behavior)[5, 16,49, 50, 51]			0.86	0.89	0.88	0.59	
I have replaced at least one water-intensive crop with a low-water-demand crop in the past two years(AAC1)	0.799	15.356					
Currently, part of my farmland is allocated to low-water-demand crops(AAC2)	0.586	4.304					

I have reduced the area under water-intensive crops in recent years(AAC3)	0.615	4.772					
I use drought-resistant varieties or species on my farm(AAC4)	0.591	2.474					
I have changed my cropping pattern in accordance with the region's water scarcity conditions(AAC5)	0.641	3.597					

Table 5. (Continued).

Discriminant Validity

To assess discriminant validity, two criteria were used: The Fornell-Larcker criterion and the HTMT ratio. According to Table 6, the square root of AVE for each construct (diagonal values) is greater than the correlations of that construct with other constructs, confirming discriminant validity[28].

Construct	(ATAC)	(SN)	(PBC)	(AC)	(AR)	(PN)	(SE)	(OP)	(HO)	(RE)	(CDP)	(BIAC)	(AAC)
(ATAC)	0.76												
(SN)	0.42**	0.75											
(PBC)	0.45**	0.38**	0.75										
(AC)	0.36**	0.33**	0.39**	0.77									
(AR)	0.40**	0.35**	0.42**	0.48**	0.76								
(PN)	0.44**	0.39**	0.37**	0.41**	0.52**	0.77							
(SE)	0.38**	0.34**	0.46**	0.35**	0.38**	0.40**	0.78						
(OP)	0.35**	0.31**	0.36**	0.32**	0.34**	0.36**	0.42**	0.75					
(HO)	0.41**	0.37**	0.40**	0.38**	0.41**	0.43**	0.47**	0.44**	0.77				
(RE)	0.39**	0.35**	0.43**	0.34**	0.37**	0.39**	0.45**	0.41**	0.46**	0.76			
(CDP)	0.34**	0.30**	0.33**	0.37**	0.39**	0.42**	0.36**	0.31**	0.38**	0.35**	0.77		
(BIAC)	0.48**	0.43**	0.50**	0.44**	0.47**	0.51**	0.45**	0.40**	0.49**	0.46**	-0.45**	0.77	
(AAC)	0.42**	0.38**	0.44**	0.39**	0.42**	0.46**	0.40**	0.36**	0.43**	0.41**	-0.51**	0.55	0.77

Table 6. Discriminant Validity (Fornell-Larcker Criterion)

Table 7 shows the HTMT ratios, where all values are below the threshold of 0.85 and range from 0.35 to 0.59, confirming acceptable discriminant validity for all pairs of constructs[30].

Construct	(ATAC)	(SN)	(PBC)	(AC)	(AR)	(PN)	(SE)	(OP)	(HO)	(RE)	(CDP)	(BIAC)	(AAC)
(ATAC)													
(SN)	0.49												
(PBC)	0.52	0.44											
(AC)	0.41	0.38	0.45										
(AR)	0.46	0.41	0.48	0.56									
(PN)	0.51	0.45	0.43	0.48	0.59								
(SE)	0.44	0.39	0.53	0.41	0.44	0.46							
(OP)	0.41	0.36	0.42	0.38	0.40	0.42	0.49						
(HO)	0.47	0.43	0.46	0.44	0.47	0.43	0.54	0.51					
(RE)	0.45	0.41	0.50	0.40	0.43	0.45	0.52	0.48	0.53				
(CDP)	0.39	0.35	0.38	043	0.45	0.48	0.42	0.36	0.44	0.41			
(BIAC)	0.54	0.49	0.57	0.51	0.54	0.58	0.52	0.46	0.56	0.53	0.51		
(AAC)	0.48	0.44	0.50	0.45	0.48	0.53	0.46	0.42	0.49	0.47	0.58	0.63	

Table 7. HTMT Ratio

Assessment of the Structural Model

After confirming the measurement model, the structural model was evaluated using the bootstrapping method with 5,000 subsamples. The proposed model was able to explain 52% of the variance in behavioral intention ($R^2 = 0.52$) and 38% of the variance in the adoption of alternative cropping (behavior) ($R^2 = 0.38$). Additionally, the model explained 35% of the variance in ascription of responsibility ($R^2 = 0.35$) and 42% of the variance in personal norms ($R^2 = 0.42$), respectively (Figure 3). The results of Table 8 and Figure 4 show that out of the 14 direct hypotheses of the study, 12 hypotheses were confirmed and 2 hypotheses (H7 and H8) were rejected.

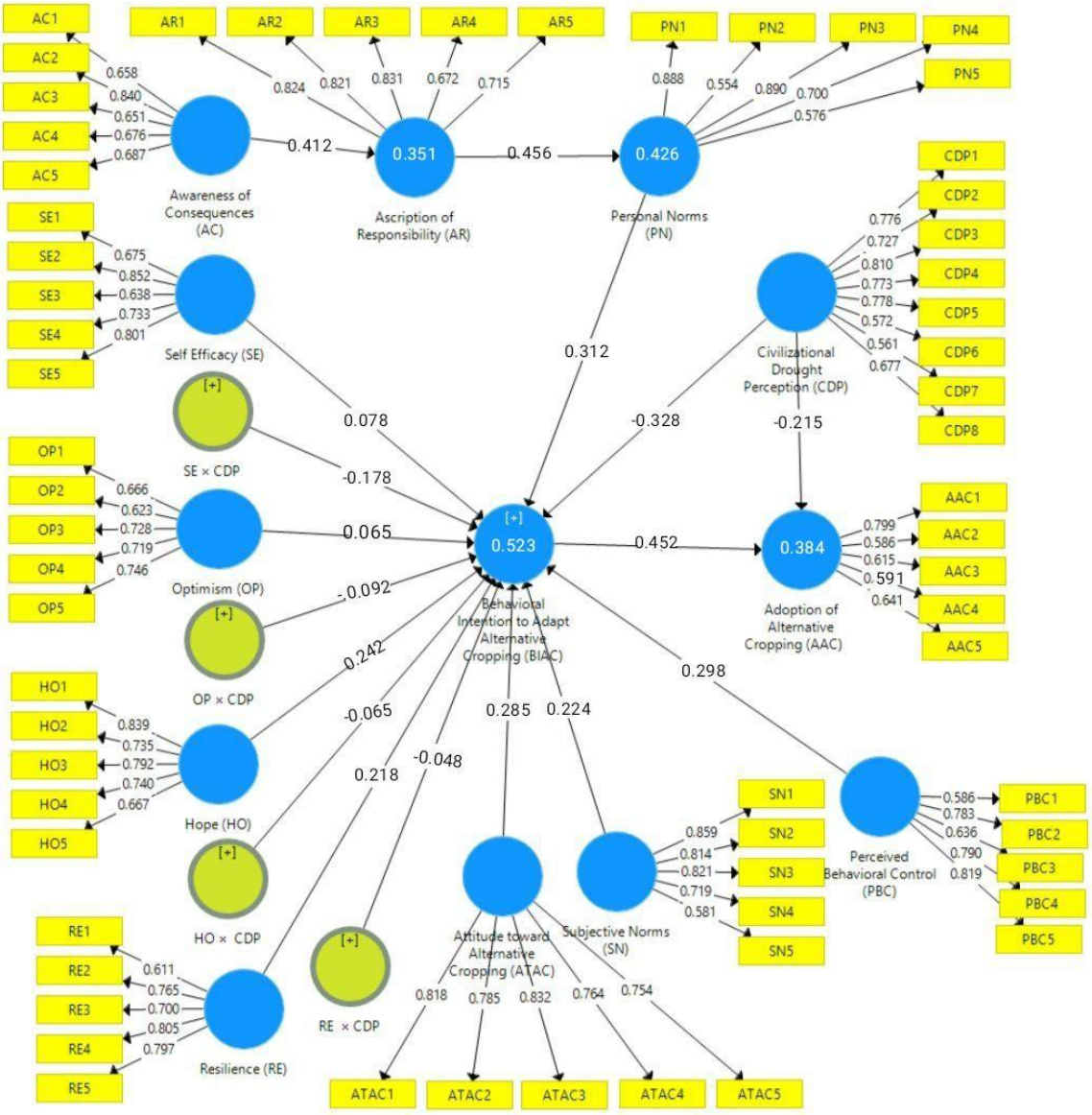


Fig.3. Path model with standardized factor loadings

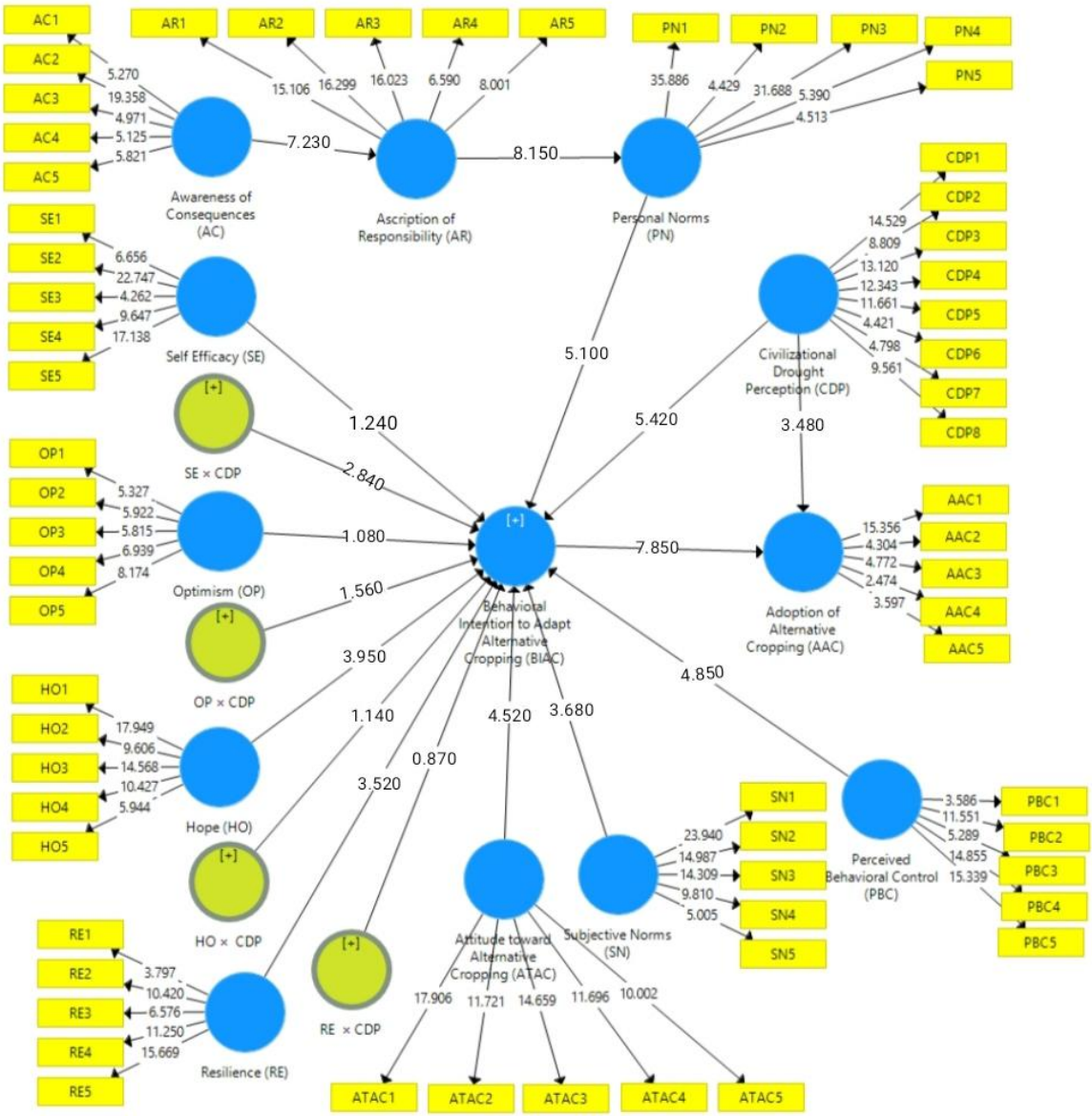


Fig 4. Path model with t-values

Hypothesis	Path	β	t-value	p-value	95% CI (LL, UL)	f²	R²	Result
H1	Attitude → Behavioral Intention	0.285	4.520	0.000	0.16, 0.39]	0.12	0.52	Confirm
H2	Subjective Norms → Behavioral Intention	0.224	3.680	0.000	[0.11, 0.34]	0.08	0.52	Confirm
H3	Perceived Behavioral Control → Behavioral Intention	0.298	4.850	0.000	[0.18, 0.41]	0.14	0.52	Confirm
H4	Awareness of Consequences → Ascription of Responsibility	0.412	7.230	0.000	[0.30, 0.52]	0.20	0.35	Confirm
H5	Ascription of Responsibility	0.456	8.150	0.000	[0.35, 0.56]	0.26	0.42	Confirm

	→ Personal Norms							
H6	Personal Norms → Behavioral Intention	0.312	5.100	0.000	[0. 19,0.43]	0.15	0.52	Confirm
H7	Self-Efficacy → Behavioral Intention	0.078	1.240	0.241	[-0.04, 0.19]	0.01	0.52	Reject
H8	Optimism → Behavioral Intention	0.065	1.080	0.215	[-0.18, 0.05]	0.01	0.52	Reject
H9	Hope → Behavioral Intention	0.242	3.950	0.000	[0.12, 0.30]	0.09	0.52	Confirm
H10	Resilience → Behavioral Intention	0.218	3.520	0.000	[0.10, 0.33]	0.07	0.52	Confirm
H11a	Civilizational Drought Perception × Self-Efficacy → Behavioral Intention	-0.178	2.840	0.005	[- 0.30, -0.06]	0.04	0.52	Confirm
H11b	Optimism × Civilizational Drought Perception → Behavioral Intention	-0.092	1.560	0.119	[- 0.20, 0.02]	0.01	0.52	Reject
H11c	Hope × Civilizational Drought Perception → Behavioral Intention	-0.065	1.140	0.254	[- 0.17, -0.04]	0.01	0.52	Reject
H11d	Resilience × Civilizational Drought Perception → Behavioral Intention	-0.048	0.870	0.384	[- 0.14, -0.05]	0.00	0.52	Reject
H12	Civilizational Drought Perception → Behavioral Intention	-0.328	5.420	0.000	[-0.44, -0.21]	0.16	0.52	Confirm
H13	Behavioral Intention → Adoption of Alternative Cropping (Behavior)	0.452	7.850	0.000	[0.34, 0.56]	0.28	0.38	Confirm
H14	Civilizational Drought Perception → Adoption of Alternative Cropping (Behavior)	-0.215	3.480	0.001	[-0.33, -0.09]	0.08	0.38	Confirm

Table 8. Results of research structural models

Note: β = standardized path coefficient; LL = lower limit; UL = upper limit; CI = confidence interval; f^2 = effect size (Cohen, 1988).

The results of effect size (f^2) show that ascription of responsibility ($f^2 = 0.26$) and behavioral intention → adoption of alternative cropping ($f^2 = 0.28$) have medium to large effects. Awareness of consequences ($f^2 = 0.20$), civilizational drought perception → intention ($f^2 = 0.16$), personal norms ($f^2 = 0.15$), and perceived behavioral control ($f^2 = 0.14$) have medium effects. In contrast, self-efficacy ($f^2 = 0.01$) and optimism ($f^2 = 0.01$) had very small and non-significant effects, consistent with the rejection of hypotheses H7 and H8. The interaction effect of self-efficacy × civilizational drought ($f^2 = 0.04$) also had a small but significant effect on behavioral intention.

Mediation Analysis

To test mediation, the bootstrapping method was used. The results of Table 9 show that ascription of responsibility and personal norms play a chain mediating role in the relationship between awareness of consequences and behavioral intention. Additionally, behavioral intention plays a partial mediating role in the relationship between attitude, subjective norms, perceived behavioral control, personal norms, hope, and resilience with the actual adoption of alternative cropping.

Hypothesis	Path	β	t-value	p-value	95% CI (LL, UL)	Type of Mediation	Result
H15a	Awareness of Consequences → Ascription of Responsibility → Personal Norms → Behavioral Intention	0.059	3.250	0.001	[0.03, 0.09]	Partial Mediation	Confirm
H15b	Awareness of Consequences → Ascription of Responsibility → Behavioral Intention	0.032	2.480	0.013	[0.01, 0.06]	Partial Mediation	Confirm
H15c	Awareness of Consequences → Personal Norms → Behavioral Intention	0.048	2.960	0.003	[0.02, 0.08]	Partial Mediation	Confirm
H15d	Ascription of Responsibility → Personal Norms → Behavioral Intention	0.142	4.180	0.000	[0.08, 0.21]	Partial Mediation	Confirm
H16a	Attitude → Behavioral Intention → Adoption of Alternative Cropping (Behavior)	0.129	3.850	0.000	[0.07, 0.19]	Partial Mediation	Confirm
H16b	Subjective Norms → Behavioral Intention → Adoption of Alternative Cropping (Behavior)	0.101	3.240	0.001	[0. 05,0.16]	Partial Mediation	Confirm
H16c	Perceived Behavioral Control → Behavioral Intention → Adoption of Alternative Cropping (Behavior)	0.135	4.020	0.000	[0.08, 0.20]	Partial Mediation	Confirm
H16d	Personal Norms → Behavioral Intention → Adoption of Alternative Cropping (Behavior)	0.141	4.260	0.000	[0.08, 0.21]	Partial Mediation	Confirm
H16e	Hope → Behavioral Intention → Adoption of Alternative Cropping (Behavior)	0.109	3.480	0.000	[0.06, 0.17]	Partial Mediation	Confirm
H16f	Resilience → Behavioral Intention → Adoption of Alternative Cropping (Behavior)	0.099	3.150	0.001	[0.05, 0.15]	Partial Mediation	Confirm

Table 9. Results of Mediation Analysis

Moderation Analysis (The Role of Civilizational Drought)

To test the moderation hypothesis examining the moderating role of civilizational drought in the relationship between self-efficacy and behavioral intention, the bootstrapping method with 5,000 subsamples was used. The results showed that the interaction effect (self-efficacy × civilizational drought) on behavioral intention was significant ($\beta = -0.178$, $t = 2.840$, $p = 0.005$). This finding indicates that civilizational drought moderates the relationship between self-efficacy and behavioral intention. Specifically, at high levels of civilizational drought, high self-efficacy, instead of facilitating the intention to adopt alternative cropping, hinders

it (psychological capital inversion). This finding clearly demonstrates the occurrence of the "psychological capital inversion" phenomenon under conditions of civilizational crisis.

Assessment of the Model's Predictive Power

The predictive relevance of the model was assessed using the Stone-Geisser[37, 38] Q^2 criterions through the blindfolding method. Q^2 values for ascription of responsibility (Q^2 = 0.24), personal norms (Q^2 = 0.29), behavioral intention (Q^2 = 0.35), and adoption of alternative cropping (Q^2 = 0.28) were all greater than zero, indicating moderate to strong predictive relevance of the model[39]. The PLSpredict results also showed that the model has acceptable out-of-sample predictive power, and the prediction error for all endogenous constructs was lower than the baseline criterion.

Discussion

The Effect of Attitude on Behavioral Intention to Adopt Alternative Cropping

The findings of this study showed that attitude, with a path coefficient of 0.285 and an effect size of 0.12 has a positive and significant effect on behavioral intention to adopt alternative cropping. This finding indicates that the more positive farmers' evaluation of alternative cropping is and the more they consider it an effective solution to combat water scarcity, the more willing they will be to adopt it. This finding is fully justifiable within the framework of the Theory of Planned Behavior[9]; according to this theory, attitude, as an individual's positive or negative evaluation of performing a behavior, is one of the main predictors of behavioral intention. This finding is consistent with the study by Menatizadeh et al [11], who showed that a positive attitude toward efficient irrigation significantly explains farmers' intention. Furthermore, Yazdanpanah et al [41] in Iran found that farmers' positive attitude toward low-water-demand crops plays a determining role in their intention to replace rice cultivation. Based on this finding, it is recommended that educational and extension programs focus on strengthening farmers' positive attitude toward alternative cropping by demonstrating its economic, environmental, and social benefits.

The Effect of Subjective Norms on Behavioral Intention to Adopt Alternative Cropping

The findings showed that subjective norms, with a path coefficient of 0.224 and an effect size of 0.08, have a positive and significant effect on behavioral intention to adopt alternative cropping. This finding indicates that social pressure and expectations of reference groups (family, peers, agricultural experts) can drive farmers toward adopting alternative cropping. This finding can be explained based on the Theory of Planned Behavior[9]; according to this theory, subjective norms, as an individual's perception of social pressure to perform or not perform a behavior, influence behavioral intention. This finding is consistent with the study by Azadi et al [43] in Kermanshah, who showed that social norms play an important role in farmers' intention to adapt to water scarcity. Menatizadeh et al [11]also found that subjective norms arising from peer pressure are among the most important predictors of water-saving behavior. The effect size of 0.08, which is the smallest effect among the significant TPB variables, indicates that subjective norms alone cannot solve the problem of adopting

alternative cropping and should be considered alongside other factors. Based on this finding, it is recommended to use the capacity of local leaders, pioneer farmers, and extension experts to promote alternative cropping and create positive social pressure.

The Effect of Perceived Behavioral Control on Behavioral Intention to Adopt Alternative Cropping

The findings showed that perceived behavioral control, with a path coefficient of 0.298 and an effect size of 0.14, has a positive and significant effect on behavioral intention to adopt alternative cropping. This finding clearly indicates that the more technical ability, access to inputs, and financial capacity farmers have to change their cropping pattern, the stronger their intention to adopt alternative cropping will be. This finding can be explained based on the Theory of Planned Behavior[9]; according to this theory, perceived behavioral control, as an individual's perception of the ease or difficulty of performing a behavior, influences behavioral intention. This finding is consistent with the study by Zhu et al [12] in China, who showed that perceived behavioral control is the strongest predictor of intention to adopt modern irrigation technologies. Yazdanpanah et al [41] also found in Iran that perceived behavioral control plays a determining role in farmers' intention to replace rice cultivation with low-water-demand crops. Habibi Fath Abadi et al [43] showed that access to financial and technical resources is one of the main barriers to adopting alternative cropping in Iran. Based on this finding, it is recommended to provide low-interest financial facilities, technical training packages, and easy access to alternative cropping inputs for farmers to strengthen their perceived behavioral control.

The Effect of Awareness of Consequences on Ascription of Responsibility

The findings of this study showed that awareness of consequences, with a path coefficient of 0.412 and an effect size of 0.20 has a positive and significant effect on ascription of responsibility. This finding indicates that the more aware farmers are of the negative consequences of continuing water-intensive cropping (such as depletion of groundwater resources, soil degradation, and threats to food security), the greater their sense of responsibility for these consequences will be. This finding is fully justifiable within the framework of Schwartz's Norm Activation Model[10]; according to this model, awareness of consequences, as an individual's understanding of the negative consequences of not performing an environmental behavior, is the first step in activating the normative chain. This finding is consistent with the study by Huo et al [14] in China, who showed that awareness of the negative consequences of drought is the most important predictor of ascription of responsibility. Savari et al [21] also found in Iran that awareness of consequences has a significant effect on farmers' ascription of responsibility regarding the water crisis. Gholamrezai et al [45] showed that awareness of environmental consequences plays a key role in activating farmers' moral norms. Based on this finding, it is recommended that educational programs based on the objective display of the consequences of water-intensive cropping (such as documentaries on land subsidence and declining water wells) be designed and implemented to increase farmers' awareness.

The Effect of Ascription of Responsibility on Personal Norms

The findings showed that ascription of responsibility, with a path coefficient of 0.456 and an effect size of 0.26 has a positive and significant effect on personal norms. This finding indicates that the more responsibility farmers feel for the negative consequences of water-intensive cropping, the stronger their internal moral obligation to adopt alternative cropping will be. This finding can be explained based on the Norm Activation Model[10]; according to this model, ascription of responsibility, as an individual's sense of responsibility for negative environmental consequences, leads to the activation of personal norms. This finding is consistent with the study by Menatizadeh et al [15] in China, who showed that ascription of responsibility plays a key mediating role in the relationship between awareness of consequences and personal norms. Savari et al [13] in Iran showed that ascription of responsibility is one of the main factors in the formation of ethical norms in agricultural water management. The effect size of 0.26, which is the largest effect among the NAM variables, indicates that ascription of responsibility plays a key role in activating farmers' personal norms. Based on this finding, it is recommended that participatory workshops focusing on social and ethical responsibility toward water resources be held for farmers.

The Effect of Personal Norms on Behavioral Intention to Adopt Alternative Cropping

The findings showed that personal norms, with a path coefficient of 0.312 and an effect size of 0.15, have a positive and significant effect on behavioral intention to adopt alternative cropping. This finding clearly indicates that farmers with an internal moral obligation toward water conservation have a stronger intention to adopt alternative cropping. This finding is fully justifiable within the framework of the Norm Activation Model[10]; according to this model, personal norms, as an internal moral obligation to perform or refrain from a specific behavior, lead to intention and subsequently actual behavior. Huo et al [14] also found that personal norms play a key mediating role in the relationship between awareness of consequences and water conservation behaviors. Azadi et al [43] in Kermanshah showed that personal norms are among the most important predictors of farmers' intention to adapt to water scarcity. Based on this finding, it is recommended that value-based programs grounded in farmers' cultural-religious beliefs (such as educational sessions in mosques focusing on verses and traditions related to water conservation) be designed and implemented to strengthen personal norms.

Non-Significant Effect of Self-Efficacy and Optimism on Behavioral Intention and Confirmation of Component-Specific Psychological Capital Inversion

One of the most important findings of this study, which requires deep theoretical reflection, was the non-significant effect of self-efficacy ($\beta = 0.078$, $p = 0.241$) and optimism ($\beta = 0.065$, $p = 0.215$) on behavioral intention to adopt alternative cropping. This finding is in clear contradiction with the theoretical foundations of Luthans et al [7], who consider self-efficacy and optimism as the main components of psychological capital. However, this contradiction can be explained using the concept of "psychological capital inversion" introduced in the theoretical foundations of this study[4].

The results of the moderation analysis showed that the interaction effect of self-efficacy × civilizational drought on behavioral intention is significant (β = -0.178, t = 2.840, p = 0.005, f^2 = 0.04). This finding clearly indicates that at high levels of civilizational drought perception, high self-efficacy, instead of facilitating the intention to adopt alternative cropping, hinders it. This finding is consistent with the study by Chipfupa et al [8], who showed that under severe climate crisis conditions; high self-efficacy can lead to resistance to change. Anderson et al [3] in their meta-analysis showed that under existential threats, self-efficacy is more prone to inversion than other components. Tahernejad et al [48] also in a qualitative study in Iran showed that under severe drought conditions, high self-efficacy can lead to passivity and resistance to change.

In contrast, the interaction effects of optimism × civilizational drought (β = -0.092, p = 0.119, f^2 = 0.01), hope × civilizational drought (β = -0.065, p = 0.254, f^2 = 0.00), and resilience × civilizational drought (β = -0.048, p = 0.384, f^2 = 0.00) on behavioral intention were not significant. This finding indicates that, unlike self-efficacy, the other three components of psychological capital do not undergo inversion under civilizational drought conditions.

Reasons for rejecting the inversion of optimism:

Although optimism may lead to "risk denial" under certain conditions, this transformation is not definitive and depends on the severity of the threat and the cultural context. In the present study, optimism was not significant in either the direct or the interaction path. This finding is consistent with the study by Maziya et al [6], who showed that optimism maintains its positive effect under water scarcity conditions and does not undergo inversion. Reasons for rejecting the inversion of hope:

Hope, as the ability to design alternative pathways to achieve goals, has a flexible nature. Under civilizational crisis conditions, hope turns into "active effort to find innovative solutions" rather than "messianic expectation." This finding is consistent with the study by Maziya et al [6], who showed that hope plays a facilitating role under water scarcity conditions and its effect is not reversed.

Reasons for rejecting the inversion of resilience:

Resilience, as the ability to bounce back from adversity and failure, has a resistant nature. Under civilizational crisis conditions, resilience turns into "active resistance and creative adaptation" rather than "passive tolerance." This finding is consistent with the study by Chipfupa et al [8], who showed that psychological resilience is one of the most important predictors of adopting modern agricultural technologies under water scarcity conditions. Keshavarz & Karami[22] in Iran showed that resilience plays a key role in farmers' adaptation to drought, and its effect is not reversed under crisis conditions.

The findings of this study indicate that psychological capital inversion is a component-specific phenomenon and cannot be generalized to all dimensions of psychological capital. Only self-efficacy (which emphasizes control over conditions) undergoes inversion in crises

beyond individual control, while optimism, hope, and resilience (which emphasize flexibility and adaptation) maintain their positive or non-significant effects. This finding offers a new theoretical framework for explaining component-specific psychological capital inversion in environmental crises and suggests that extension interventions should be designed based on the type of component, not uniformly for all components.

Based on this key finding, it is recommended that the dominant approach in extension programs, which emphasizes strengthening individual self-efficacy, be fundamentally revised, and instead focus on "group and network empowerment" and "strengthening social capital." Furthermore, extension programs should strengthen hope and resilience as facilitating components under civilizational crisis conditions.

The Effect of Hope on Behavioral Intention to Adopt Alternative Cropping

The findings showed that hope, with a path coefficient of 0.242 and an effect size of 0.09 has a positive and significant effect on behavioral intention to adopt alternative cropping. This finding indicates that farmers who have various pathways for adapting to water scarcity in mind and can design alternative routes to achieve their goals have a stronger intention to adopt alternative cropping. This finding can be explained based on psychological capital theory[7]; according to this theory, hope, as the ability to design alternative pathways to achieve goals, is one of the key components of psychological capital that influences adaptive behaviors. This finding is consistent with the study by Maziya et al [6] in South Africa, who showed that hope has a positive effect on adopting climate change adaptation strategies. Chipfupa et al [8] also found that hope is one of the most important predictors of farmers' adaptive behaviors under water scarcity conditions. Li et al [47] showed that hope plays a key role in strengthening farmers' psychological resilience. Based on this finding, it is recommended that educational workshops based on designing alternative cropping pathways be held for farmers to strengthen their ability to find innovative solutions to combat water scarcity.

The Effect of Resilience on Behavioral Intention to Adopt Alternative Cropping

The findings showed that resilience, with a path coefficient of 0.218 and an effect size of 0.07 has a positive and significant effect on behavioral intention to adopt alternative cropping. This finding indicates that farmers who have the ability to bounce back from adversity and failure and maintain their composure in the face of the water crisis have a stronger intention to adopt alternative cropping. This finding can be explained based on psychological capital theory[7]; according to this theory, resilience, as the ability to bounce back from adversity and failure, is one of the key components of psychological capital that influences adaptive behaviors. This finding is consistent with the study by Chipfupa et al [8], who showed that psychological resilience is one of the most important predictors of adopting modern agricultural technologies under water scarcity conditions. Keshavarz & Karami[22] in Iran showed that resilience plays a key role in farmers' adaptation to drought. Based on this finding, it is recommended that educational programs based on strengthening psychological

resilience (such as sharing the experiences of successful farmers in coping with the water crisis) be designed and implemented for farmers.

The Effect of Civilizational Drought Perception on Behavioral Intention and Actual Adoption of Alternative Cropping

The findings showed that civilizational drought perception, with a path coefficient of -0.328 and an effect size of 0.16 has a negative and significant effect on behavioral intention to adopt alternative cropping. Furthermore, civilizational drought perception, with a path coefficient of -0.215 and an effect size of 0.08, has a negative and significant effect on the actual adoption of alternative cropping. This finding clearly indicates that the perception of drought as a civilizational threat is the most important psychological barrier to adopting alternative cropping. This finding can be explained based on the theory of "Decision Paralysis"; when farmers feel they are facing a pervasive and uncontrollable threat, they become passive instead of taking active action. This finding is consistent with the study by Hadei and Hopke[4], who identified civilizational drought as the main cause of farmers' passivity. Moridi et al [5] showed that despite the identification of alternative technical options, psychological barriers play a more determining role in adopting alternative cropping. Based on this finding, it is recommended that programs to reduce civilizational drought perception be designed and implemented with an "objective display of consequences" approach (such as documentaries on land subsidence and declining water wells) to transform abstract awareness into a sense of urgency and practical action.

The Effect of Behavioral Intention on Actual Adoption of Alternative Cropping (Intention-Behavior Gap)

The findings showed that behavioral intention, with a path coefficient of 0.452 and an effect size of 0.28 has a positive and significant effect on the actual adoption of alternative cropping. This finding indicates that behavioral intention is the best predictor of actual behavior, and farmers with a stronger intention to adopt alternative cropping are more likely to perform this behavior in practice. This finding can be explained based on the Theory of Planned Behavior[9]; according to this theory, behavioral intention is considered the best predictor of actual behavior. This finding is consistent with the study by Sheeran[52], who showed that behavioral intention explains, on average, 28% of the variance in actual behavior. However, the effect size of 0.28 indicates a considerable gap between intention and behavior (Intention-Behavior Gap). This gap may be due to structural barriers (such as lack of capital, lack of access to inputs, and economic risk). Sandra et al [17] also in Europe showed that behavioral intention explains only part of the variance in farmers' actual behavior. Based on this finding, it is recommended that policymakers, in addition to strengthening farmers' intention, also remove the structural and economic barriers to adopting alternative cropping.

Mediation Analysis: The Mediating Role of Behavioral Intention

The results of the mediation analysis showed that behavioral intention plays a partial mediating role in the relationship between attitude ($\beta = 0.129$), subjective norms ($\beta = 0.101$),

perceived behavioral control (β = 0.135), personal norms (β = 0.141), hope (β = 0.109), and resilience (β = 0.099) with the actual adoption of alternative cropping. In other words, these variables not only directly affect behavioral intention but also indirectly affect the actual adoption of alternative cropping by strengthening intention. This finding is fully consistent with the integrated TPB and NAM model presented by Sandra et al [17]and Maziya et al [6]. Furthermore, studies by Huo et al [14] and Menatizadeh et al [15] showed that behavioral intention plays a key mediating role in the relationship between external factors and water conservation behaviors. However, the non-confirmation of mediation through self-efficacy and optimism once again indicates the occurrence of the "component-specific psychological capital inversion" phenomenon. This finding is consistent with the studies by Hadei and Hopke[4], who showed that under civilizational drought conditions, self-efficacy may turn into "overconfidence" and prevent the adoption of new strategies.

Chain Mediation Analysis in the Norm Activation Model

The results of the chain mediation analysis showed that awareness of consequences, through ascription of responsibility and personal norms, has a significant indirect effect on behavioral intention (β = 0.059, p = 0.001). Furthermore, the indirect paths of awareness of consequences → ascription of responsibility → behavioral intention (β = 0.032), awareness of consequences → personal norms → behavioral intention (β = 0.048), and ascription of responsibility → personal norms → behavioral intention (β = 0.142) were all significant. This finding indicates that the Norm Activation Model[10] provides a suitable psychological mechanism for explaining the intention to adopt alternative cropping. This finding is consistent with the study by Savari et al [21] in Iran, who showed that the NAM chain (awareness → ascription → personal norm) significantly explains farmers' intention to conserve water. Gholamrezai et al [44] also found in Iran that personal norms play a key mediating role in the relationship between awareness of consequences and farmers' environmental behaviors. Savari et al [13] showed that the NAM chain is a suitable framework for explaining farmers' ethical behaviors in water management.

Conclusion

This study, by presenting and empirically testing an integrated model based on the Theory of Planned Behavior and the Norm Activation Model, and by introducing the concept of "civilizational drought" as a novel framework for analyzing the water crisis in Iran, has achieved a deeper understanding of the factors influencing the intention and actual adoption of alternative cropping among smallholder irrigated farmers. The main conclusion of this study is that the transition to civilizational drought is not merely a hydrological or climatic phenomenon, but rather the result of complex interactions among socio-cognitive factors (attitude, subjective norms, perceived behavioral control), moral-altruistic factors (awareness of consequences, ascription of responsibility, personal norms), and farmers' psychological capital (particularly hope and resilience). The findings showed that among smallholder irrigated farmers in Kermanshah, perceived behavioral control and personal norms act as the strongest predictors of behavioral intention to adopt alternative cropping, while self-efficacy and optimism have no significant effect. Furthermore, behavioral intention was identified as

the most important predictor of actual adoption of alternative cropping, although a considerable gap exists between intention and behavior.

The most important and innovative finding of this study is the empirical confirmation of the "psychological capital inversion" phenomenon through moderation analysis. Contrary to the common assumptions of psychological theories (such as Bandura's) that consider self-efficacy always a positive factor, this study showed that under high civilizational drought perception, high self-efficacy, instead of facilitating the intention to adopt alternative cropping, turns into "excessive trust in traditional methods" and hinders behavior change. This finding offers a new theoretical framework for explaining the awareness-behavior paradox in environmental crises.

Another innovative finding of this study is the component-specific nature of psychological capital inversion. Contrary to the initial expectation that all components of psychological capital (self-efficacy, optimism, hope, and resilience) would undergo inversion under civilizational drought conditions, the findings showed that only self-efficacy undergoes inversion (H11a confirmed). Optimism (H11b), hope (H11c), and resilience (H11d) not only do not undergo inversion, but hope and resilience have a positive and significant effect on behavioral intention. This finding indicates that psychological capital inversion is a component-specific phenomenon and cannot be generalized to all dimensions of psychological capital.

From a policy perspective, this study shows that any technical solution for promoting alternative cropping, without simultaneous attention to socio-cognitive factors (attitude, subjective norms, perceived behavioral control), moral factors (personal norms), and specific components of psychological capital (hope and resilience), is doomed to failure. Moreover, extension approaches based solely on strengthening individual self-efficacy must be fundamentally revised, and instead, focus should be placed on strengthening hope and resilience and on group and network empowerment, because under civilizational crisis conditions, individualistic approaches are not only ineffective but can also produce counterproductive results. By critiquing purely technical and economic approaches in water management, this study emphasizes the necessity of attending to psychological and institutional dimensions in water resource policymaking and demonstrates that solving Iran's water crisis is not possible without simultaneously reforming cognitive, moral, and specific psychological capital components of farmers.

Research Implications

Theoretical Implications

This study has contributed to enriching the literature on disaster risk management, environmental psychology, and climate change adaptation behavior in five ways:

Operationalization of the concept of "civilizational drought" at the local level using quantitative methods: While previous studies[4] have mainly focused on conceptualizing this phenomenon, the present study showed that civilizational drought can be measured and

analyzed using survey instruments and structural equation modeling in local communities. By confirming the moderating role of civilizational drought in the relationship between self-efficacy and behavioral intention, the findings showed that this construct, beyond being an abstract concept, is an operational and measurable variable that can determine the direction and strength of relationships between psychological and behavioral variables.

Integration of three theoretical domains—TPB, NAM, and psychological capital into a unified model: By presenting a model that simultaneously considers the role of socio-cognitive factors (attitude, subjective norms, perceived behavioral control), moral-altruistic factors (awareness of consequences, ascription of responsibility, personal norms), and psychological capital (self-efficacy, optimism, hope, resilience) in explaining the intention and behavior of adopting alternative cropping, this study has integrated these three domains. While previous studies have focused either on socio-cognitive dimensions[11], moral dimensions[14, 15], or psychological dimensions[6,8], the findings of the present study showed that these three domains interactively influence the intention and behavior of adopting alternative cropping.

Identification of the priority of collective and normative variables over individual variables under severe crisis conditions: The findings showed that under structural crises such as civilizational drought, collective and normative psychological variables (personal norms and hope) play a more determining role in the intention to adopt alternative cropping compared to individual variables (self-efficacy and optimism). This finding extends the Value-Belief-Norm theory into the context of disaster risk management and shows that in the face of civilizational threats, collective norms and social responsibility take precedence over individual beliefs in personal abilities.

Empirical confirmation of the "psychological capital inversion" phenomenon and identification of the moderating role of civilizational drought: The most innovative achievement of this study is the empirical confirmation of a phenomenon that had previously been proposed only theoretically[4]. The findings showed that civilizational drought moderates the relationship between self-efficacy and behavioral intention (in other words, under high civilizational drought perception, high self-efficacy, instead of facilitating the intention to adopt alternative cropping, hinders it). This finding empirically confirms the concept of "psychological capital inversion" that had been proposed in the theoretical literature and shows that under existential threats, positive psychological variables may undergo inversion and the direction of their relationship with adaptive behaviors may be reversed. This achievement offers a new theoretical framework for explaining the awareness-behavior paradox in environmental crises.

Identification of the mediating role of behavioral intention and the NAM chain in the relationship between predictors and behavior: The findings showed that behavioral intention not only directly affects the actual adoption of alternative cropping but also, as a partial mediator, transmits the effects of attitude, subjective norms, perceived behavioral control, personal norms, hope, and resilience to actual behavior. Furthermore, the full NAM chain (awareness of consequences → ascription of responsibility → personal norms → behavioral

intention) was significantly confirmed. This achievement indicates that the integrated model of TPB, NAM, and psychological capital provides suitable psychological mechanisms for explaining the process of transforming cognitive factors into actual behavior, and understanding farmers' adaptation behavior without considering these mechanisms would be incomplete.

Practical Implications

The main practical achievement of this study, beyond presenting a theoretical model, is the extraction of an operational prioritization framework for increasing the intention and actual adoption of alternative cropping, based on real data from an agricultural region in Iran (Kermanshah). This study shows policymakers, water managers, and agricultural extension agents which cognitive, moral, and psychological components are effective under severe crisis conditions and which are ineffective. Based on the findings, perceived behavioral control and personal norms were identified as the strongest predictors of behavioral intention. In contrast, the study reveals that focusing on individual empowerment through strengthening self-efficacy and optimism at the local level has little effect and is considered an ineffective priority in water crisis management. This scientific prioritization enables the direction of resource allocation by targeting the strengthening of attitude, subjective norms, perceived behavioral control, personal norms, hope, and resilience, and prevents the waste of limited resources in low-impact areas.

This study also helps water management organizations (such as regional water companies and agricultural jihad organizations) to shift their approach from "technical water management" to "social and psychological water management." In other words, instead of focusing solely on dam construction and water transfer, these organizations can increase farmers' adaptation intention and behavior against drought by investing in "strengthening personal norms," "increasing perceived behavioral control," and "strengthening hope and resilience." For example, holding educational workshops with the presence of pioneer farmers who share their lived experiences of adopting alternative cropping can simultaneously strengthen farmers' attitude, subjective norms, and hope.

One of the most important practical achievements of this study is the warning regarding conventional extension approaches. By confirming the "psychological capital inversion" phenomenon, agricultural extension agents are warned that under civilizational crisis conditions, strengthening individual self-efficacy alone is not only ineffective but can also produce counterproductive results and lead to "excessive trust in traditional methods." Instead, focus should be placed on group empowerment, social networks, and strengthening collective capital. This combined approach can move local communities from a state of passivity and waiting for government assistance to a state of agency and collective cooperation for water resource conservation, ultimately preventing the gradual collapse of the livelihood system and forced migration. The conceptual model presented in this study can be used as a tool for assessing farmers' psychological readiness to adopt alternative cropping and for designing targeted interventions.

Research Limitations and Suggestions for Future Studies

Despite its considerable achievements, this study faced limitations that can guide future research. First, data were collected cross-sectionally, which does not allow for examining dynamic changes in relationships among variables over time; therefore, longitudinal studies with follow-up of samples at different time intervals are recommended for future researchers. Second, the measurement of variables was based on self-reporting, and there is a possibility of reporting bias, although the full collinearity VIF method ruled out the presence of severe common method bias; nevertheless, using mixed quantitative and qualitative methods such as in-depth interviews and participant observation, along with objective data (such as actual water consumption and cultivated area), can increase the validity of the findings. Third, the statistical population was limited to smallholder irrigated farmers in Kermanshah Province, and generalization of results to other groups or regions should be done with caution; therefore, conducting comparative studies in different regions of Iran and the world with different climatic, social, and cultural conditions can increase the generalizability of the findings. Fourth, in-depth qualitative data were not collected to better understand the social and cultural contexts affecting the adoption of alternative cropping, and future studies with a qualitative approach can help identify the underlying mechanisms of the psychological capital inversion phenomenon. Fifth, other mediating variables such as social capital, institutional trust, or social resilience may also explain the relationships among the research variables, and adding them to the model in future studies is recommended. Sixth, examining the moderating role of variables such as age, education, and gender in the relationships among the research variables using multi-group analysis can help identify more vulnerable groups and design targeted interventions. Seventh, although in this study behavioral intention and actual adoption of alternative cropping were measured separately, the intention-behavior gap requires deeper investigation. Finally, conducting interventional and quasi-experimental studies to examine the effectiveness of the identified strategies (such as strengthening personal norms, increasing perceived behavioral control, and strengthening hope and resilience) in increasing the intention and actual adoption of alternative cropping can contribute to the external validity of the results and provide more effective practical solutions for policymakers.

Data availability

The datasets generated during and/or analyzed during the current study are not publicly available due to ethical restrictions and the confidentiality agreement with the participants, which prohibits public sharing of individual-level survey data collected from smallholder farmers. The datasets are available from the corresponding author on reasonable request.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

1. IPCC. (2023). Climate change 2022: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. https://doi.org/ https://doi.org/ 10.1017/ 9781009325844.
2. Zscheischler, J., Martius, O., Westra, S., Bevacqua, E., Raymond, C., Horton, R. M., van den Hurk, B., Aghakouchak, A., Mahecha, M. D., Maraun, D., Ramos, A. M., Ridder, N. N., Thiery, W., & Vignotto, E. (2020). A typology of compound weather and climate events. Nature Reviews Earth & Environment, 1(7), 333–347. https://doi.org/10.1038/s43017-020-0060-z.

3. Anderson, T. G., Pons, D., Taylor, M. J., Xuruc, A., Rodríguez Salvatierra, H. H., Guido, Z., Sullivan, J. A., Liverman, D., & Anchukaitis, K. J. (2025). Complexity and mediating factors in farmers' climate perceptions and agricultural adaptation strategies in the Guatemalan Dry Corridor. Climate Risk Management, 178(7),1-28. https://doi.org/ 10.1007/s10584-025-03978-5.

4. Hadei, M., & Hopke, P. K. (2025). Civilizational Drought: A Missing Category in the Understanding of Iran's Water Crisis. Environmental Science & Technology, 59(27), 13529–13531. https://doi.org/10.1021/acs.est.5c07392.

5. Moridi, M., Ghanbari Movahed, R., Rahimian, M., & Gholamrezai, S. (2026). Understanding farmers' adaptation behavior against drought: Application of the Health Belief Model. Journal of Agricultural Science and Technology, 28(1), 119–131. https://doi.org/10.48311/jast.2026.16867.

6. Maziya, M.; Mdoda, L.; Mvelase, L.P.S. (2024). The Role of Psychological Capital on Climate Change Adaptation Among Smallholder Farmers in the uMkhanyakude District of KwaZulu-Natal, South Africa. Climate, 12(12), 213. https://doi.org/10.3390/cli12120213.

7. Luthans, F., & Youssef-Morgan, C. M. (2017). Psychological capital: An evidence-based positive approach. Annual Review of Organizational Psychology and Organizational Behavior, 4(1), 339–366. https://doi.org/10.1146/annurev-orgpsych-032516-113324.

8. Chipfupa, U., Tagwi, A. & Wale, E. (2021). Psychological capital and climate change adaptation: Empirical evidence from smallholder farmers in South Africa. Jamba: Journal of disaster risk studies. 13(1), 1-12. .http://www.jamba.org.za/index.php/jamba https://doi.org /10.4102/ jamba.v13i1.1061.

9. Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179–211. https://doi.org/10.1016/0749-5978 (91)90020-T.

10. Schwartz, S. H. (1977). Normative influences on altruism. In L. Berkowitz (Ed.), Advances in experimental social psychology. 10, 221–279. New York: Academic Press. https://doi.org/10.1016/S0065-2601(08)60358-5.

11. Menatizadeh.M., Ataei., P., Karimi., H. & Khoshnodifar, Z. (2024). The cognitive and behavioral processes of water conservation among farmers: the role of responsibility and awareness. Sustainable Water Resources Management.10 (5). https://doi.org/10.1007/s40899-024-01160-w

12. Zhu, L., Yutao, W., Liu, L., Tan, Zh., Ke, S., Hu, N., Qu., Sh., & Han, G. (2025). Chinese Farmers' Low-Carbon Agricultural Technology Adoption Behavior and Its Influencing Factors. Agriculture, 15(10), 1055. https://doi.org/10.3390/agriculture15101055.

13. Savari, M., Eskandari Damaneh, H., & Eskandari Damaneh, H. (2025). Ethical evolution in the management of water resources: The role of developed norms on decreasing groundwater usage in

Iranian agricultural practices. Agricultural Water Management, 318, https://doi.org/10.1016/j.agwat.2025.109714.

14. Huo, X., Zou, X., Zhang, Y., & Ma, R. (2025). Driving factors of pro-environmental behavior among rural tourism destination residents-considering the moderating effect of environmental policies. Sci Rep **15**, 7663. https://doi.org/10.1038/s41598-025-92457-z.

15. Menatizadeh, M., Ataei, P., Karimi, H., & Mottaghi Dastenaei, A. (2025). An integrated logical-ethical behavioral model for the analysis of water conservation decisions. Environmental and Sustainability Indicators.28, https://doi.org/10.1016/j.indic.2025.101001.

16. Valizadeh, N., Sadighi, H., Farhadian, H. & Bijani, F. (2021). Human ecological analysis of farmers' pro-environmental behaviour in the face of drought: Application of Norm Activation Theory. Water and Environment Journal. 35(4): 1337-1347. https://doi.org/10.1111/wej.12733.

17. Sandra, M., Cañizares, S., Cabeza-Ramírez, L.J., González-Mohino, M. & López-Castro, J. A. (2026). An integrated model to assess the psychosocial determinants of the intention to adopt organic farming practices. Journal of Environmental Management, 404. 129321. https://doi.org/10.1016/j.jenvman.2026.129321.

18. Sharafi, L., & Zarafshani, K. (2025). Conceptualizing water bankruptcy in forbidden plains of Iran (Case study: Mahidasht plains). Advanced Technologies in Water Efficiency, 5(4), 15-45. doi: 10.22126/atwe.2025.12466.1178.

19. Scoones, I. (1998). Sustainable rural livelihoods: A framework for analysis (IDS Working Paper No. 72). Brighton: Institute of Development Studies.

20. Savari, M., Eskandari Damaneh, H., & Eskandari Damaneh, H. (2023). Effective factors to increase rural households' resilience under drought conditions in Iran. International Journal of Disaster Risk Reduction, 90, 103644. https://doi.org/10.1016/j.ijdrr.2023.103644.

21. Savari, M., Abdeshahi, A., Gharechaee, H.R., & Nasrollahian, O. (2021). Explaining farmers' response to water crisis through theory of the norm activation model: Evidence from Iran. International Journal of Disaster Risk Reduction, 60, 102284. https://doi.org/10.1016/j.ijdrr.2021.102284.

22. Keshavarz, M., & Karami, E. (2016). Farmers' pro-environmental behavior under drought: Application of protection motivation theory. Journal of Arid Environments, 127(4), 128-136. https://doi.org/10.1016/j.jaridenv.2015.11.010.

23. Agricultural Jihad Organization of Kermanshah Province (2025). Agricultural statistic of Kermanshah Province.http://www.kermanshah.,aj.ir.

24. Cochran, W. G. (1977). Sampling techniques (3rd ed.). New York: John Wiley & Sons.

25. Hair, J. F., Howard, M. C., & Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. Journal of Business Research, 109, 101-110. https://doi.org/10.1016/j.jbusres.2019.11.069.

26. Kalton, G. (1983). Introduction to survey sampling. Beverly Hills, CA: SAGE Publications.

27. Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. Psychometrika, 16(3), 297-334. https://doi.org/10.1007/BF02310555.

28. Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18(1), 39-50. https://doi.org/10.2307/3151312.

29. Nunnally, J. C., & Bernstein, I. H. (1994). Psychometric theory (3rd ed.). New York: McGraw-Hill.

30. Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. Journal of the Academy of Marketing Science, 43(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8.

31. Ringle, C. M., Wende, S., & Becker, J. M. (2022). SmartPLS 4. Oststeinbek: SmartPLS GmbH. https://www.smartpls.com.

32. Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal, 6(1), 1–55. https://doi.org/10.1080/10705519909540118.

33. IBM Corp. (2020). IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY: IBM Corp.

34. Field, A. (2018). Discovering statistics using IBM SPSS statistics (5th ed.). Los Angeles: SAGE Publications.

35. Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behavior Research Methods, 40(3), 879-891. https://doi.org/10.3758/BRM.40.3.879.

36. Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. International Journal of e-Collaboration, 11(4), 1-10. https://doi.org/10.4018/ijec.2015100101.

37. Stone, M. (1974). Cross-validatory choice and assessment of statistical predictions. Journal of the Royal Statistical Society: Series B (Methodological), 36(2), 111-133. https://doi.org/10.1111/j.2517-6161.1974.tb00994.x.

38. Geisser, S. (1975). The predictive sample reuse method with applications. Journal of the American Statistical Association, 70(350), 320-328. https://doi.org/10.1080/01621459.1975.10479865.

39. Hair, J. F., Hult, G. T. M., Ringle, C. M., and Sarstedt, M. (2017). A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM) (2nd ed.). Sage Publications.

40. Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J. H., Ting, H., Vaithilingam, S., & Ringle, C. M. (2019). Predictive model assessment in PLS-SEM: Guidelines for using PLSpredict. European Journal of Marketing, 53(11), 2322-2347. https://doi.org/10.1108/EJM-02-2019-0189.

41. Yazdanpanah, M., Zobeidi, T., Sieber, S., Löhr, K., & Homayoon, S. B. (2022). Replacing rice with lower water consumption crops: Green policy implications for Iran. Climate Research, 88, 101–114. https://doi.org/10.3354/cr01700.

42. Ataei, P., Karimi, H., & Es'haghi, S. R. (2022). Socio-cognitive analysis of farmers' water conservation behaviour: The case of the Kavar plain, Iran. Science Progress, 105(4), 368504221128777. https://doi.org/10.1177/00368504221128777.

43. Azadi, Y., & Yaghoubi, J., Gholamrezai, S., & Rahimi-Feyzabad, F. (2024). Farmers' adaptation behavior to water scarcity in Western Iran: Application of the values-identity-personal norms model, Agricultural Water Management, 306(C). https://doi.org/10.1016/j.agwat.2024. 109210.

44. Habibi Fath Abadi, N., Khajehpour, E., & Nabieyan, S. (2023). Investigating the effect of agricultural products insurance on acceptance of adaptation to climate change in agricultural sector. Water Harvesting Research, 6(2), 238–247. https://doi.org/10.22077/jwhr.2024.7326.1129.

45. Gholamrezai, S., Rahimi, F., & Azadi, Y. (2025). Psychological factors influencing groundwater conservation: A case study of farmers in the restricted plain of Rumeshkan, Iran. Applied Water Science. https://doi.org/10.1007/s13201-025-02578-z.

46. Rezaei, A., Fatemi, M., & Shennan, C. (2025). Healthy agricultural production: A socio-psychological and environmental approach to sustainable food systems in Fars province, Iran. Frontiers in Sustainable Food Systems, 9, 1539777. https://doi.org/10.3389/fsufs.2025.1539777.

47. Li, H., Qi, N., Li, Zh., & Ma, W. (2022). The relationship between farmers' entrepreneurial behavior and macroeconomics based on the probit regression model and entrepreneurial psychological capital. Frontiers in Psychology, 13, 954874. https://doi.org/10.3389/fpsyg.2022.954874.

48. Tahernejad, A., Sohrabizadeh, S., & Mashhadi, A. (2024). Exploring factors affecting psychological resilience of farmers living in drought-affected regions in Iran: A qualitative study. Frontiers in Psychology, 15, 1418361. https://doi.org/10.3389/fpsyg.2024.1418361.

49. Ahmadi Chegeni, M., Rahimian, M., Ghanbari Movahhed, R., Gholamrezaei, S., & Molavi, H. (2025). Determinants of the behavioral intention of irrigated wheat farmers toward cultivating low-water-demand crops. Journal of Space Economy & Rural Development, 14(52), 103–124. https://doi.org/10.61882/serd.14.52.7.

50. Karimi, M., Ahmadi Nadoushan, M., & Chavoshi, E. (2025). A decade-long spatial analysis of opportunistic rice cultivation in a water-stressed agricultural landscape. Environmental Monitoring and Assessment, 197(2), 216. https://doi.org/10.1007/s10661-025-13656-9.

51. Nasiri, A. R., Shahangian, S. A., Kerachian, R., & Zobeidi, T. (2024). Exploring socio-psychological factors affecting farmers' intention to choose a low-water-demand cropping pattern for water resources conservation: Application of the health belief model. Agricultural Water Management, 295(4), 108768. https://doi.org/10.1016/j.agwat.2024.108768.

52. Sheeran, P. (2002). Intention Behavior Relations: A Conceptual and Empirical Review. European Review of Social Psychology, 12(1), 1–36. https://doi.org/10.1080/14792772143000003.