

IWRA 2021 Online Conference: “One Water, One Health”



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Adaptation Strategies and Barriers to Water Scarcity: A Qualitative Analysis in Southern Iran

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Introduction

- A huge body of studies and reports worldwide including, confirmed that water, both quantitatively and qualitatively, is under pressure due to many reasons such as population growth, industrialization, extended drought, economic growth, expansion of agricultural land and last but not least climate change (**Tajeri Moghadam et., 2020**).
- There is evidence that by 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity and the two-thirds of the world's population could be living under water stress (**Yazdanpanah et al., 2015**), and by 2040 are predicted that 14 countries in the Middle East would face “extremely high water stress” (**Tajeri Moghadam et., 2020**).
- Iran is located in the southwest of Asia in the Middle East region. The main factors that are causing the water problems in Iran could be mentioned as progressive increase in population, migration and uneven population distribution, appearance of drought as a result of climate change, inefficiency in water irrigation systems and excessive withdrawal of groundwater resources (**Edalat and Abdi, 2018**).

Water scarcity

- There are different definitions of water scarcity as well as various perceptions regarding its concept. Physical or quantity related water scarcity, caused by natural or human induced causes, is a widespread term which is attributed to the temporary short fall in water resource volume to meet water needs (**Forouzani et al.,2013**).
- When a large number of people in an area are water insecure for a significant period of time, then we can call that area water scarce. It is important to note, however, that there is no commonly accepted definition of water scarcity. Whether an area qualifies as “water scarce” depends on, for instance: a) how people’s needs are defined – and whether the needs of the environment, the water for nature, are taken into account in that definition; b) what fraction of the resource is made available, or could be made available, to satisfy these needs; c) the temporal and spatial scales used to define scarcity (**Rijsberman,2006**).
- The Iranian agriculture sector has been severely affected by climate change. Frequent and prolonged drought causing severe water shortages has led to the salinization and desertification of arable land (**Rouzaneh et al., 2021**).

Adaptation and agriculture

- **The IPCC (2001)**, definition of adaptation is adopted here, which defines adaptation as the ability of a system to adjust in response to actual or expected climatic stimuli to moderate harm or to cope with the consequences. Agricultural adaptation to climate change refers to adjustments to farming systems in response to actual and/or anticipated climatic and non-climatic stimuli and conditions in order to avoid or to alleviate related risks or to realise potential opportunities (**Smit et al., 2000; IPCC, 2001**).

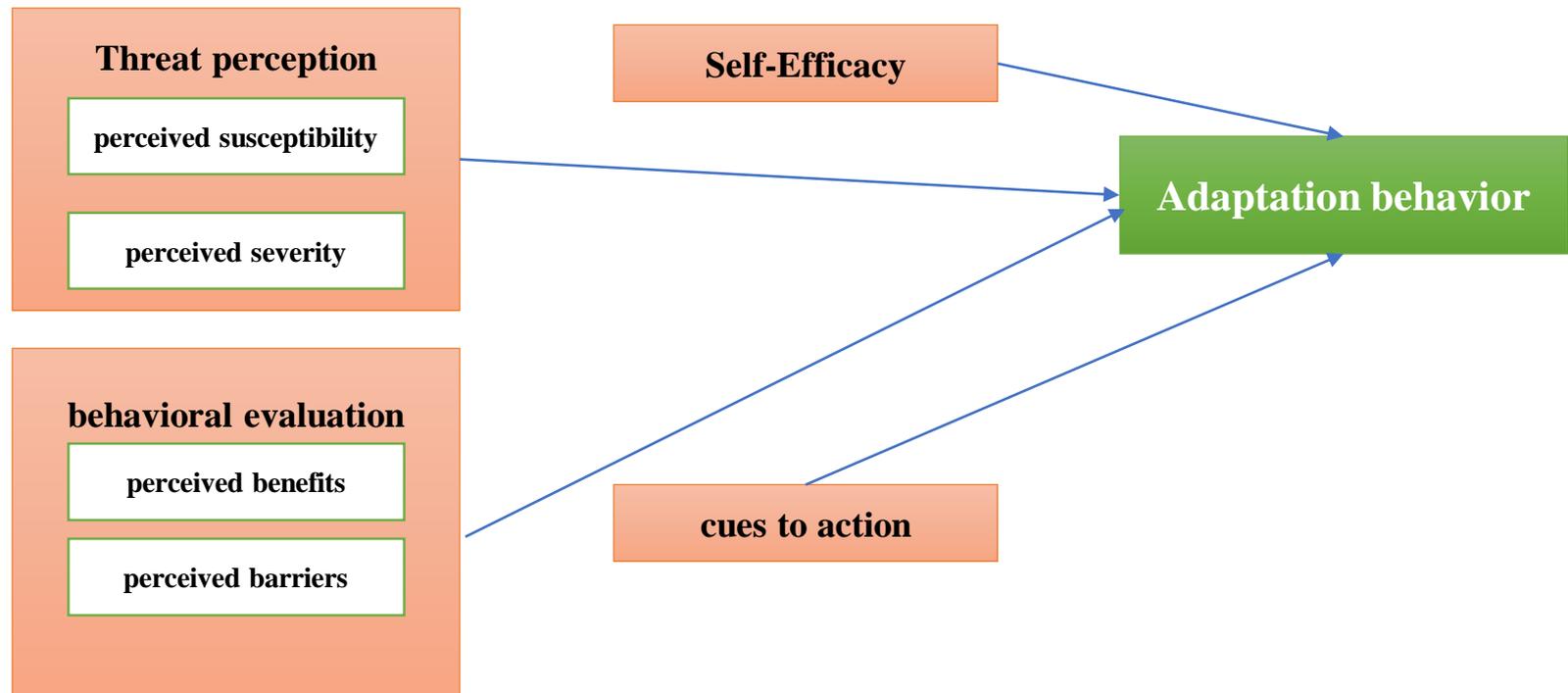
Classification of agricultural adaptations to climate change.

Concept or attribute	Types	Key measures or examples
Purposefulness/intent	Autonomous/spontaneous	Independently implemented by private actors, e.g., an adjustment to agricultural practices through crop diversification.
Time scales	Planned	Deliberate policy intervention by public sector agencies, e.g., setting of regulations, standards and policies.
	Anticipatory/proactive	Undertaken before impacts are observed, e.g., purchase of insurance, early-warning system.
	Responsive/reactive	After initial impacts are manifested, e.g., changes in farm practices.
	<i>Ex ante</i>	Measures to prevent or hinder climate damage.
Temporal scope	<i>Ex post</i>	Measures to regulate responsibility and compensation when damage happens.
	Short term	Can be implemented through a change in variable inputs to production.
Spatial scope	Long term	An adjustment to capital stock may be required.
	Scales	Adaptation measures at farm, plant, community, region, sector, national and international scales
Level of strategies	On-farm measures	Diversification of crop varieties, species change, shifting planting seasons, changing crop management practices etc.
	Off-farm measures	Diversifying into off-farm employment, investing in non-farm assets, migrating to new industries etc.
	Form	Hard adaptation
Agents	Soft adaptation	Focuses on information, capacity building, policy and strategy development, and institutional arrangements.
	Players	Farmers, industries, governments and non-government organisations.

Sources: Smit & Pilifosova (2001); Bryant et al. (2000); IPCC (2001, 2007).

Theoretical model and research approach

- **The Health Belief Model (HBM):** The HBM was emerged by social psychologists, Godfrey Hochbaum and Irwin Rosenstock in the early 1950s. It is the most common and most popular theoretical model in health-promotion behavior, and preventive health behaviors and focuses on people's beliefs about their decisions (Tajeri Moghadam et al., 2020).
- In the HBM, threat perception and behavioral evaluation are the two main components. Threat perception component includes two sub-components, which are perceived susceptibility and anticipated severity. Behavioral evaluation component also consists of two sub-components, which are perceived benefits and perceived barriers (Fig. 1) (Simsekoglu and Lajunen, 2008).



Materials and Methods

- the main purpose of this study is to investigate the perception of farmers' risk of water scarcity and identify the main **Adaptation Strategies and Barriers to Water Scarcity** in southern Iran.
- Due to the application of **qualitative approach** in this study, from **semi-structured in-depth** interviews to better understand farmers' perceptions of risk, strategies and barriers to their adaptation, with residents of Dashtestan region (20 people) as one of the agricultural areas with dry climate recent droughts in southern Iran.
- To analyze the results of this study, the **Health Belief Model** (HBM) has been used due to the possibility of interpreting adaptive behaviors based on two dimensions of this model, namely farmers' risk perception and how farmers respond to water scarcity.
- Choosing a health belief model because of its appropriate capabilities, including: the ability to assess risk perception and modify adaptive behaviors in the field of environment issues and having appropriate structures to assess people's perception and predictive power.
- Limits of quantitative research methods have determined orientation to the qualitative instruments which are more reliable in certain circumstances.

Results

➤ Adaptation strategies to Water Scarcity

Types	Percentage
water resources management	20.83
technical management	70.83
farm risk management	8.33

symbol	Adaptation strategies	Frequency
S18	Increase the use of animal manure	17
S1	Change irrigation system to drip	15
S19	Plant pest control (spraying)	15
S3	Night irrigation	13
S21	Product insurance	12
S2	Low irrigation	11
S6	Cultivation of low-water crops	8
S16	Reducing the area under cultivation	7
S15	Proper plowing	7
S22	Lining irrigation canals	5

➤ Adaptation Barriers to Water Scarcity

Types	Percentage
institutional	23.52
economic	35.29
social	41.17

symbol	Barriers	Frequency
B1	Lack of support from government and responsible institutions	15
B3	Financial Problems	13
B10	Lack of cooperation of farmers	13
B4	Problems of administrative bureaucracy	9
B11	Lack of training	7
B12	high costs	4
B14	Lack of effective facilities	2

Conclusions and Discussion

- Water management for agriculture is becoming increasingly complex.
- Water scarce farms require innovative and sustainable adaptation strategies in order to maintain the productive capacity of the resource base.
- A better understanding of adaptation choices to address increasing water stress is of great importance to policy makers if the past phenomenal agricultural growth is to be sustained and to ensure food security for the country in the changing global environment.
- These results highlight the need for policymakers to recognize drought in these areas and to provide institutional and legal facilities for the development of adaptive methods in these areas.
- Also, the need to pay attention to the impact of the social dimension of adaptive behavior can guide policymakers. Adopting sustainable approaches will help in the development of the agricultural sector.
- Promoting farmers' confidence through educational programs to enable them to overcome any perceived barriers and difficulties in water conservation activities will improve adherence to water conservation behavior among the population.

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