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Mechanisms to change farmers' drought adaptation behaviors in Sistan and Baluchistan Province, Iran

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Introduction: Frequent droughts in Iran have imposed economic and social losses on farmers. To mitigate drought implications, farmers' behaviors should be shifted towards drought adaptation. This research mainly aimed to study mechanisms for changing farmers' drought adaptation behaviors in Sistan and Baluchistan Province.

Methods: The research was conducted among farmers in this province ($N = 950$). The sample whose size was estimated at 275 farmers by Krejcie and Morgan's table was taken by the stratified random sampling technique. The research instrument was a researcher-made questionnaire. Data were analyzed by $SPSS_{23}$ and $AMOS_{23}$ software. The comprehensive action determination model was validated by confirmatory factor analysis. Furthermore, structural equation modeling was used to explore the components influencing farmers' drought adaptation behaviors.

Results and discussion: According to the results, personal norms, attitudes, objective barriers, and subjective barriers had positive and significant effects on the farmers' intention to apply drought adaptation strategies. As well, the farmers' adaptation behaviors were influenced by their behavioral intentions, objective barriers, and subjective barriers. It can be concluded that changing the mechanism of farmers' behaviors toward drought adaptation is shaped by the processes included in the comprehensive action determination model in which norms, habits, situational influences, and intentional processes are involved.

KEYWORDS

climate change, comprehensive action determination model, drought adaptation, farmer behavior, sustainable agriculture

1. Introduction

The environmental quality is imperiled by various factors such as global warming, water pollution, and the high rate of desertification throughout the world (Bahta, 2020; David et al., 2020). There has been a tremendous impact of global warming on water resources, as it has entailed droughts (Gebrehiwot and van der Veen, 2020). Drought is one of the most destructive climatic events and causes huge losses in both the natural resources sector and human life (Barghi et al., 2018; Hallaj et al., 2021; Shariatzadeh et al., 2021). Drought has various characteristics in different regions, including the long-term decline in mean precipitation. Global statistics show that the number and intensity of droughts are on the rise in Asia, Southern Africa, the United States, and Brazil (Khetwani et al., 2020; Hamid et al., 2022; Van Huong et al., 2022), which has significant adverse effects on the ecosystem, economy, and society. Its next ramifications include the increased level of poverty and livelihood instability in rural areas (Naveen et al., 2014; Muthelo et al., 2019; El-Khalifa et al., 2022; Shariatzadeh and Bijani, 2022). As a natural hazard, drought has turned Iran into a country in one of the most critical conditions in this respect among all countries. Drought impacts result from interactions between natural events (deficient rainfall) and people's demand for water, and human activities can aggravate drought effects (Romiyani et al., 2020; Abidin et al., 2022). The issue has been exacerbated considering that, despite recent extensive droughts in Iran, agencies and officials have not paid adequate attention to the effects of drought on rural people's living dimensions, resilience, and viability. They have also considered it superficially and have taken thoughtless and interim measures to cope with it. Indeed, human behaviors can be implicated in a large part of these challenges and their strategies (Abidin et al., 2022; Almoussawi et al., 2022; Mirzaei et al., 2022; Panyasing et al., 2022; Arjomandi et al., 2023).

Drought has had numerous effects on the economic, social, and environmental sustainability of farmers' livelihoods (Shafii et al., 2019; Chenani et al., 2021; Yazdanpanah et al., 2022). The direct impacts of drought include crop loss, the decline in groundwater tables, more forest and pasture conflagrations, and higher mortality rates of domestic animals and wildlife. It also has indirect effects, such as the decline in crop yields, the increase in goods prices, unemployment, and immigration (Prokopy et al., 2013; Chilimba et al., 2020; Indrayani and Madjid, 2021; Zobeidi et al., 2021, 2022). In addition, some social impacts of drought on farmers' livelihood include the loss of social welfare, decrease in physical and mental health, increase in social isolation, more conflicts, decline in trust, loss of integrity and adaptation, loss of social capital, increase in mistrust to governmental institutions, increase in working hours, the reduction of free time, and increased risk of divorce and destabilization of the family system, which radically challenges farmers' livelihood sustainability (Hayati et al., 2010; Keshavarz and Karami, 2013; Keshavarz et al., 2013; Rouzaneh et al., 2020; Temsas et al., 2021). Ahmadi and Manoochehri (2020) state that persistent droughts and water scarcity cause the susceptibility and severe instability of livelihood in rural areas by reducing livelihood assets and the lack of revolutionizing institutions, inefficient local and governmental structure and management, and adoption of negative strategies.

Jamshidi and Anabestani (2022) revealed that infrastructural, trade service and economic indicators were most effective in resilience to drought. In an assessment of the role of meteorological and hydrological droughts in the dry-up of the Bakhtegan and Tashk lakes, Mozafari et al. (2022) found that although the decline in rainfall and the increase in temperature were involved in the shrinkage of the studied lakes, other factors were involved too. According to these researchers, not only the climatic drought but also human factors were responsible for the dry-up of these lakes. Shabanali Fami et al. (2021) listed five general solutions for water resource management — irrigation management and moisture retention, agronomic operation management, optimization of family economy, reinforcement of communications and information, and revision of social activities. Solimani et al. (2021) also mentioned implementing irrigation and technology modernization projects, cultivating drought-resistant species (rapeseed and medicinal plants), shifting the sowing date, using greenhouse cultivation, diversifying the cultivation of alternative crops, creating an appropriate financial support system compatible with farmers' economic conditions, training and enhancing users' technical knowledge, and stabilizing income sources as some approaches to adapting to climatic changes such as drought.

Neisi et al. (2020) studied the temporal perspective of farmers regarding their drought risk management behavior and suggested focusing on shifting farmers' views from retrospective to present-oriented, and especially prospective views as a policy strategy in water resources management planning. Romiyani et al. (2020) suggested such measures as developing a land planning scheme, modifying the cropping pattern, interacting with relevant international and regional institutions to strengthen drought alerting and monitoring systems, and continuously training relevant agents. In Savari et al. (2019) study, it was found that drought has had the greatest effect on income distribution and living expenses from the economic aspect; spatial belonging, social security, and welfare from the social aspect; the pollution of the environment and territorial resources from the environmental aspect; and people's cooperation and participation from the institutional aspect. Saja et al. (2018) suggested the use of such indicators as a social asset, social justice, social belief, social structure, and social mechanism for farmers' social resilience in facing the drought. In a study on drought in rural areas of Australia, Kiem and Austin (2016) concluded that the adaptive capacities should be expanded to subdue the impacts of drought on the economy and community of rural areas for which the view on drought should be shifted from an unexpected and destructive event to increased resilience.

According to Keshavarz et al. (2013), vulnerable and less vulnerable families faced with drought have tried to adapt to the conditions by applying drought-coping strategies. Nevertheless, constraints in assets (physical, natural, and environmental) have prevented the implementation of strategies that would be effective in coping with drought. Ashraf and Kumar (2013) mentioned crop diversification, multi-crop agriculture, changes in farm inputs, water management, correct water consumption, borrowing, and migration as the solutions for farmers' families to cope with drought. Campbell et al. (2016) considered four steps for the application of drought-coping strategies, i.e., measures to be adopted at the planting phase, measures to retain soil moisture (e.g., mulching, adjusting irrigation interval, and using drip irrigation), strategies applied in drought period (e.g., water purchase, water rationing, and the use of plant fertilizers), and drought-compensating methods (e.g., the reduction of cultivation land area, employment in non-agricultural jobs, temporary migration to other regions, and livestock sale).

The review of the literature on behavioral approaches shows that based on the reasoned approach, human behavior is a reasoned choice situation. However, human behavior in the ethical approach is examined from an ethical perspective (Stern, 2000). Based on Hallaj et al. (2018) study, most farmers have a biospheric and altruistic view, and moral norms have the greatest impact on farmers' environmental behavior. Tajeri Moghadam et al. (2018) analyzed farmers' water conservation behavior by the cultural theory. The assessment of farmers' worldviews on the conservation of water revealed that the egalitarian worldview had the highest mean score while the individualist worldview had the lowest mean score among the farmers. According to their results, egalitarian, hierarchical, and fatalistic worldviews influenced farmers' intention for water conservation indirectly.

In recent years, various theories have been applied to account for and predict farmers' behaviors. Different contextual and behavioral factors affect the display of pro-environmental behaviors (Callejas Moncaleano et al., 2021). Contextual components refer to people's contextual characteristics and physical environment (Dreibelbis et al., 2013). These factors influence people's behaviors differently and may facilitate or limit them (Callejas Moncaleano et al., 2021). The social, economic, and technical components were indicated to be important in predicting water use (Russell and Knoeri, 2020). Environmental components refer to geographical experiences, which are related to participatory learning (Dean et al., 2016). Institutional components include organizational relationships (Kapetas et al., 2019) between water users and the water supply systems and regulations (Khair et al., 2019). Behavioral components are known as the decisive factors that may immediately influence people's behaviors. They also include measures and habits that can directly be observed and factors that affect people's mindsets (Callejas Moncaleano et al., 2021).

Since ecological behaviors are characterized by multidimensionality, the main advantage of the comprehensive action determination model (CADM) is that it integrates three groups of behavioral theories, i.e., the theory of planned behavior (TPB), norm activation model (NAM), and value-belief-norm (VBN) theory and the ipsative theory of behaviour (habit, non-logical choice). These theories have their own drawbacks. For example, TPB does not consider personal norms, whereas NAM and VBN have overlooked non-normative impacts. In the CADM, normative and non-normative constructs are integrated directly and situational and habitual effects are integrated indirectly to predict ecological behaviors (Klöckner and Blöbaum, 2010; Klöckner, 2013).

In the CADM, it is assumed that personal norms can interfere with or support non-ethical motivational constructs, such as attitudes. Personal norms are felt as ethical requirements for performing a behavior and are direct predictors of intentions in TPB. According to the NAM and VBN theories, it is theoretically assumed in CADM that personal norms should be activated before they can influence pro-environmental intentions and behaviors. They are active when the individual is aware of the negative consequences of his/her behaviors for the environment and take responsibility for them. Both awareness and responsibility, as well as social norms, activate the ethical commitment felt toward a certain behavior (Joanes et al., 2020; Russell and Knoeri, 2020).

Based on this model (Figure 1), four categories of variables influence the exhibition of ecological behavior — normative processes, habitual processes, intentional processes (including intentions and attitudes), and situational constructs (including personal characteristics, situations, and constraints). Indeed, the intention is the last step before the behavior in this process (Klöckner and Blöbaum, 2010). Normative predictors include personal and social norms, as well as awareness of needs and consequences. Social norms describe the perceived social pressure to do or avoid pro-environmental behavior. Personal norms reflect the ethical commitment to pro-environmental behavior, whereas awareness of needs perceives the shortage of certain resources. Awareness of consequences means that people take the consequences of their behavior seriously (Schwartz, 1977). For activation of the ethical obligation to perform pro-environmental behavior, the individual should partially feel pressure from his/her social environment, should be aware of the needs for the behavior, and should know the consequences of his/her behavior. Habit is defined as an automatic action shaped by past similar repeated situations in which a certain behavior has been exhibited (Fishbein and Ajzen, 2010); in other words, the habitual process is related to how behaviors are performed with the least cognitive effort (Banwo and Du, 2019). CADM also encompasses situational factors, e.g., perceived behavioral control and access to behavior.

The comprehensive action determination model (CADM) has been experimentally tested in research on, e.g., the purchase of fuel-efficient cars (Nayum and Klöckner, 2014), the prediction of automatic recycling behavior (Klöckner and Oppedal, 2011), the installation of wood pellet heating systems (Sopha and Klöckner, 2011), the selection of travel mode (Klöckner and Blöbaum, 2010), pro-environmental behaviors at work station (Banwo and Du, 2019), and psychological and behavioral factors involved in household water conservation and intention (Russell and Knoeri, 2020). It has also been applied in modified form in studying sustainable seafood consumption (Richter and Klöckner, 2017) and recycling behavior in the workplace (Ofstad et al., 2017). The theoretical framework is presented in Figure 1.

2. Research methodology

This study is a retrospective, quantitative, applied, and causal–relational research. Data were collected by the survey method. The research population was composed of all farmers in the counties of Sistan and Baluchistan Province of Iran, which had been exposed to the severest drought ($N = 950$). Based on the drought index for the 12 months leading to 10 April 2022, the counties of Hamun, Zabol, Zahedan, Saravan, and Iranshahr were in extreme drought conditions. The sample whose size was estimated by 275 farmers by Krejcie and Morgan's (1970) table was taken by the stratified random sampling technique. The sampling strata included the villages in the counties of Hamun, Zabol, Zahedan, Saravan, and Iranshahr. Thirty-one villages were selected randomly from the 12 rural districts. The sample was then taken from these 31 villages proportionally. Finally, the farmers engaged with drought in Sistan and Baluchistan Province were randomly sampled from each village.

The research instrument was a researcher-made questionnaire filled out through interviews. It was composed of sections for the farmers' demographic and agronomic attributes, social and personal norms, attitudes, habits, awareness of needs and consequences, subjective barriers, objective barriers, behavioral intention, and drought adaptation behavior. The research variables were measured by Likert's five-point scale (from completely disagree to completely agree). The face and content validity of the questionnaire was confirmed by a panel of experts and university professors (in the fields of drought and environment), and its diagnostic validity was measured by the average variance extracted

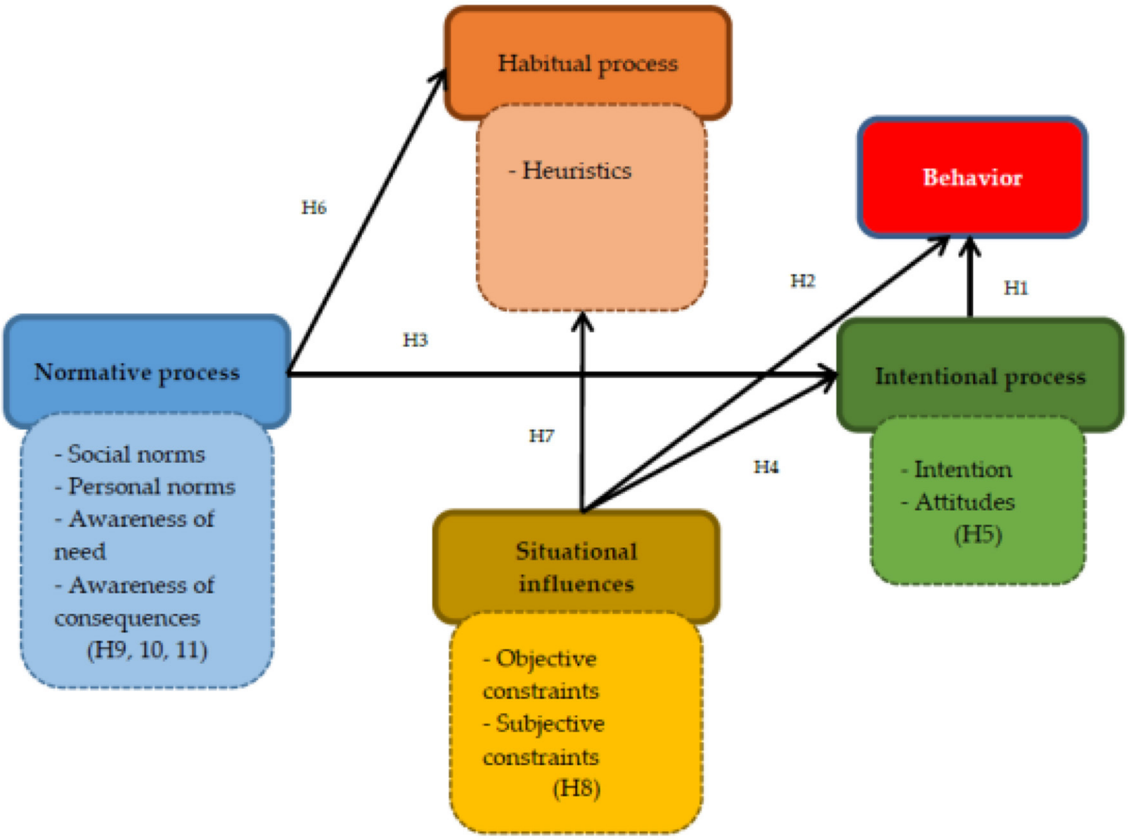

FIGURE 1
The theoretical framework of the study (Klöckner and Blöbaum, 2010).

(AVE) method. To validate the reliability of the questionnaire, a pilot study was conducted to estimate Cronbach's alpha and composite reliability (Table 1). Data were analyzed in the SPSS23 and AMOS23 software. CADM was validated by confirmatory factor analysis. Furthermore, structural equation modeling was used to explore the components influencing farmers' drought adaptation behaviors.

2.1. The study area

Sistan and Baluchistan Province has an area of 187,501 km^2 located between the longitudes 58°48' and 63°20' E. and the latitudes 25°03' and 31°29' N. The province accounts for 11.4% of Iran's area (Figure 2). It is climatically located in the arid and desert climatic zone and is composed of three distinct areas — mountainous, plains, and coastal. On the one hand, the region is influenced by numerous atmospheric currents, e.g., the wind current from the Indian Peninsula, which entails the summer monsoon. On the other hand, it is subjected to various factors, such as sub-tropical high-pressure dominance, dryness intensity, and shifts in the paths of rainy middle latitude low-pressure systems, whose main climatic characteristics are severe heat and slight precipitation. The province has hot and long summers and short winters. Its annual precipitation, which is approximately 90 mm, is very irregular and has a decreasing trend from the west to the east of the province. The counties of Hamun, Zabol, Zahedan, Saravan, and Iranshahr have been subjected to severe and extremely severe droughts in the last 10 years.

3. Results

3.1. Farmers' demographic and agronomic characteristics

Based on the demographic findings, 94.5% of the farmers were men and 5.5% were women. The farmers in Sistan and Baluchistan Province were in the age range of 20–70 years. They were, on average, 45.16 ± 10.99 years old with an average of 22.32 ± 9.46 years of experience in farming. In terms of marital status, 6.2% were single, but 93.8% were married. Regarding the educational level, 4.4% were illiterate, 24.7% had basic literacy, 21.1% were intermediate-level graduates, 35.6% had high-school diplomas, 12.4% had associate degrees, and 1.8% had bachelor's degrees. The farmers' land area was 12.76 ± 8.22 ha. In terms of ownership type, 75.3% owned their lands, while 24.7% were working on land leases. The main sources of water included wells (50.2%), rivers (23.6%), and others, e.g., springs and well-channel (26.2%). The average annual income of the farmers was 708.4 ± 15.14 million IRR.

TABLE 1 The results of the validity and reliability of the items.

Latent variables		Observed variables	Standardized loading	AVE	CR	α	*t*-value
Normative process	Social norms	(SN1) Most of those who are important to me believe that I should use drought adaptation strategies.	0.828	0.54	0.82	0.73	Fixed
		(SN2) Most of those who matter to me will be happy if I use drought adaptation strategies.	0.813				15.1
		(SN3) Farmers whose opinions I value confirm that I use drought adaptation strategies.	0.725				13
		(SN4) Most of those who are important to me believe that it is good to use drought adaptation strategies.	0.541				9.11
	Personal norms	(PN1) In my opinion, I feel good when I use drought adaptation strategies.	0.748	0.64	0.84	0.70	Fixed
		(PN2) I feel a personal responsibility to use drought adaptation strategies in the future.	0.786				12.99
		(PN3) Using drought adaptation strategies is consistent with my principles, values, and beliefs.	0.864				14.32
	Awareness of needs	(AN1) Traditional irrigation methods are an urgent problem for the management of water resources.	0.5	0.54	0.77	0.76	Fixed
		(AN2) I believe that improper use of water in agriculture causes many water shortage problems.	0.838				9.85
		(AN3) Drought adaptation strategies contribute to climate change.	0.824				10.61
	Awareness of consequences	(AC1) Drought adaptation strategies help conserve water resources.	0.84	0.52	0.76	0.74	Fixed
		(AC2) My personal decision on not using drought adaptation strategies has consequences for the environment.	0.631				8.15
		(AC3) If I do not apply drought adaptation strategies, I will contribute to the effects of the drought.	0.68				8.11
Habitual process	Habit	(HAB1) Drought adaptation strategies is something I do automatically.	0.728	0.65	0.85	0.84	Fixed
		(HAB2) Using drought adaptation strategies is something I do without thinking.	0.892				12.44
		(HAB3) Applying drought adaptation strategies is something I do with no need to be consciously reminded.	0.804				12.32
Intentional process	Intention	(INT1) I plan to use drought adaptation strategies the next time I farm.	0.773	0.57	0.86	0.76	Fixed
		(INT2) I plan to work on water conservation in the future.	0.824				14.28
		(INT3) I intend to encourage others to use drought adaptation strategies.	0.89				15.44
		(INT4) I plan to use drought adaptation strategies in the future.	0.625				10.41
		(INT5) I have a strong intention to use drought adaptation strategies in the next crop.	0.65				10.87
	Attitude	(ATT1) I have a positive attitude toward drought adaptation strategies.	0.738	0.56	0.75	0.76	Fixed
		(ATT2) I think it is useful to use drought adaptation strategies.	0.804				12.09
		(ATT3) I think drought adaptation strategies are important and other farmers should be informed about them.	0.759				11.54
		(ATT4) In my opinion, producing more crops and increasing crop yields is more important than drought.	0.704				10.76
Situational influences	Objective barriers	(OC1) How much do you have access to the necessary facilities to apply drought adaptation strategies?	0.783	0.50	0.74	0.83	Fixed
		(OC2) How much do you have access to sufficient financial resources to implement drought adaptation strategies?	0.654				6.96

(Continued)

TABLE 1 (Continued)

Latent variables		Observed variables	Standardized loading	AVE	CR	α	*t*-value
		(OC3) How affordable are drought adaptation strategies for you?	0.66				6.61
	Subjective barriers	(SC1) It is easy for me to use drought adaptation strategies at farm.	0.554	0.50	0.79	0.76	Fixed
		(SC2) There are circumstances that force me to refrain from using drought adaptation strategies while I am at farm.	0.775				8.24
		(SC3) I can easily use drought adaptation strategies when I am at farm if I want to.	0.754				8.16
		(SC4) I feel that using drought adaptation strategies is not out of my control.	0.7				7.89
Behavior		(BEHV1) Diversity in crop cultivation	0.644	0.53	0.91	0.83	Fixed
		(BEHV2) Use of proper crop rotation	0.651				9.81
		(BEHV3) Changing irrigation type and method (based on new irrigation methods)	0.716				10.63
		(BEHV4) Crop insurance	0.676				10.12
		(BEHV5) Changing the use of chemical inputs	0.628				9.52
		(BEHV6) Diversity in livestock (change in livestock or addition of livestock)	0.621				9.42
		(BEHV7) Use of new drought-resistant cultivars	0.745				10.98
		(BEHV8) Changing crop type (low-water-intensive crops)	0.982				13.51
		(BEHV9) Changing cropping date (planting, cultivating, and harvesting)	0.564				8.67
		(BEHV10) Applying conservation tillage	0.938				13.12
		(BEHV11) Renting land in other places	Eliminated				-
		(BEHV12) Employment in non-agricultural jobs	Eliminated				-
		(BEHV13) Reduction of cultivated land	Eliminated				-

3.2. Exploration of the causal model of farmers' drought adaptation behavior

The SEM was applied to analyze the components underpinning the process of farmers' drought adaptation behavior. Accordingly, the measurement part of the model was first assessed to determine the validity and reliability of the variables. Then, its structural part was assessed to confirm the theoretical relationships of the variables in the conceptual framework.

The research adopted composite reliability (CR) and average variance extracted (AVE) to measure the reliability and validity of the questionnaire, respectively. The CFA was used to check the validity of the model. The findings showed that the indicators used to measure the studied latent traits adequately fitted the theoretical foundation of the study (Table 1).

The study's conceptual model was evaluated by the indicators of χ^2/df, NFI, IFI, GFI, CFI, and RMSEA. According to the values estimated for these fitness indicators in Table 2, χ^2/df is 3.38, showing the proper fit of the model. The alternative model exploration indicators of NFI, IFI, IGFI, GFI, and CFI were used to check how well the model would perform in accounting for the dataset, especially in comparison with other possible models. These indicators were estimated at 0.92, 0.94, 0.91, 0.94, 0.91, and 0.05, respectively. Hence, the reported indicators had acceptable values for the overall fit of the theoretical model. It can, therefore, be deduced that the model generally fitted the data used.

Based on the theoretical model, habitual processes were influenced by normative processes directly and influenced farmers' drought adaptation intentions indirectly. Situational influences had direct and indirect effects on habitual processes and farmers' drought adaptation intentions and behaviors. Farmers' attitudes influenced their drought adaptation intentions directly. In addition, their intentions had a direct effect on their drought adaptation behaviors.

Based on the results, the effect of the farmers' intentions was significant on the drought adaptation behaviors ($\beta = 0.38$, $P < 0.01$), supporting hypothesis 1. The effect of subjective barriers ($\beta = 0.13$, $P < 0.05$) and objective barriers ($\beta = 0.19$, $P < 0.01$) was also significant on the farmers' drought adaptation behaviors, which confirms hypothesis 2. Personal norms ($\beta = 0.86$, $P < 0.05$) affected the farmers' drought adaptation intentions positively and significantly, but social norms had no significant impact on their intentions. Thus, hypothesis 3 is supported. The results revealed that the effect of subjective barriers ($\beta = 0.28$, $P < 0.01$) and objective barriers ($\beta = 0.13$, $P < 0.05$) was significant on the farmers' drought adaptation intentions. Accordingly, hypothesis 4 is supported. As the results showed, the farmers' attitudes had a significant effect on the drought adaptation intentions ($\beta = 0.50$,

FIGURE 2
The location of the study area.

TABLE 2 The fitness indicators of the theoretical model.

Test	Suggested value*	Proposed model
Adjusted goodness of fit Index	AGFI > 0.9	0.94
Normed chi-square (x^2/df)	x^2/df < 5	3.38
Root mean squared error of approximation	RMSEA < 0.08	0.05
Normed fit index	NFI > 0.9	0.92
Incremental fit index	IFI = Values close to 1	0.94
Comparative fit index	CFI > 0.9	0.91
Goodness fit index	GFI > 0.9	0.94

*Byrne (2016).

$P < 0.01$), supporting hypothesis 5. Furthermore, the farmers' personal norms affected their habitual processes significantly ($\beta = 0.73$, $P < 0.01$). This supports hypothesis 6. Objective barriers were found to influence habitual processes positively and significantly ($\beta = 0.13$, $P < 0.05$). The effect of subjective barriers was not significant on habitual processes among farmers. In addition, it was found that objective barriers influenced the farmers' subjective barriers significantly ($\beta = 0.32$, $P < 0.01$), supporting hypothesis 8. The effect of social norms was found to be significant on personal norms among farmers of Sistan and Baluchistan Province ($\beta = 0.70$, $P < 0.01$). Therefore, hypothesis 9 is supported. Nonetheless, awareness of consequences had no significant effect on their personal norms, refuting hypothesis 10. Eventually, it was revealed that the impact of awareness of needs was significant on their personal norms ($\beta = 0.26$, $P < 0.01$), which supports hypothesis 11 (Figure 3).

The results revealed that the coefficient of determination (R^2) was 0.976 for the farmers' personal norms. This means that 97.6% of the variance in this variable was related to social norms, awareness of needs, and consequences. Furthermore, R^2 was assessed at 0.62 for the farmers' drought adaptation intentions. Hence, 62% of the variance in this variable is captured by normative processes, farmers' attitudes, and situational influences. R^2 was calculated to be 0.568 for habitual processes. Therefore, 56.8% of the variance in habitual processes is accounted for by their personal norms and objective and subjective barriers. Moreover, R^2 was found to be 0.671 for the farmers' drought adaptation behaviors. In other words, 67.1% of the variance in their behaviors is predicted by their intentions and subjective and objective barriers.

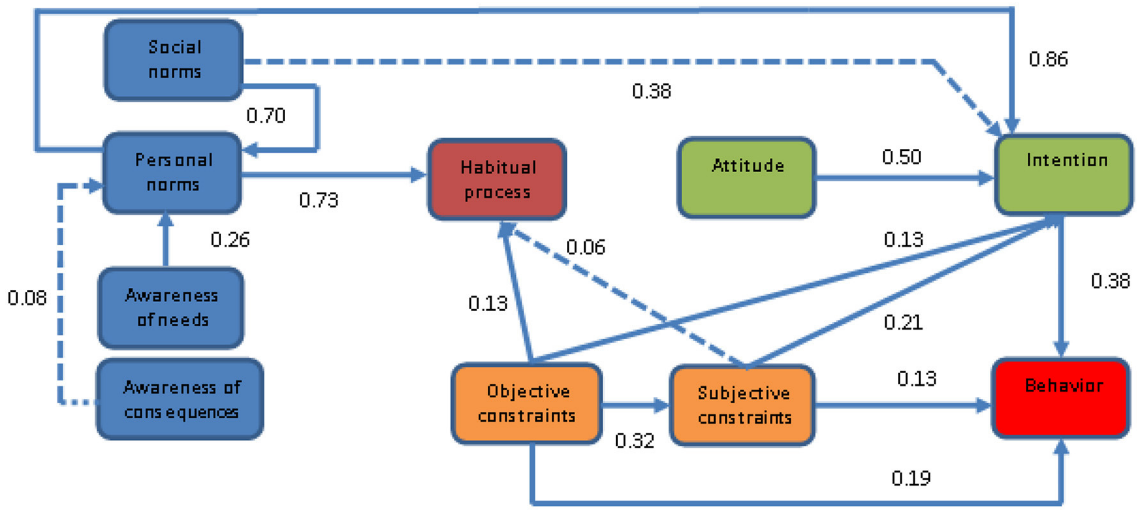

FIGURE 3
The structural model of the study.

4. Discussion

The analysis of CADM clearly indicates the promising potential of this approach, which combines the effects of intention, norms, situation, and habits on drought adaptation behavior and reflects the model's deeper distinction within and between these main determining groups. The model fit indices indicate its satisfactory fit with experimental data. All suggested influences were significant in the structural model of the research, except for three ones. As expected, the predictors from the four main categories contributed to describing drought adaptation behavior directly or indirectly. This adds to the model's robustness as a comprehensive approach. The findings indicate that in addition to the strong role of situational constraints (including the direct or indirect impacts on behavior) in determining farmers' adaptation behavior, the intentional, habitual, and normative processes play significant roles too. Thus, from an interventionist view, changing situational positions is a promising way to modify drought adaptation behavior. However, normative, intentional, and habitual processes can also cope with it and should be considered. A glance at the general impacts indicates that the key actors in determining farmers' drought adaptation behaviors are their intentions and attitudes.

sOne of the expected interactions (in this case, objective barriers that modulate the intention–behavior relationship among the farmers) was confirmed. The interaction of the access to facilities and funding resources for adopting drought adaptation strategies with behavioral intention was as expected — farmers who had limited access to facilities and funding resources somehow had to use other strategies. Hence, farmers' intentions without access to facilities and funding resources can be regarded as irrelevant because situational conditions prevent them from continually using drought adaptation strategies. This is consistent with the reports of van den Broek et al. (2019), Klöckner (2013), Russell and Knoeri (2020), and Klöckner and Oppedal (2011).

The results reveal that easy access to facilities and financial resources is the prerequisite for the formation of the habit of using drought adaptation strategies. It means that farmers who are strongly used drought adaptation strategies are more likely to have access to facilities and financial resources, which allows them to choose among choices and have the intention to use alternative strategies. Ofstad et al. (2017), Klöckner and Blöbaum (2010), Tang et al. (2022), and Poškus et al. (2021) have also reported that subjective and objective barriers are key determinants of habits.

A close look at the results provides that personal norms had a relatively powerful effect on habits and behavioral intentions. It is consistent with the theoretical assumption that norms are related to the person's value. Thus, they are much more stable than intentions, which are usually shaped immediately before a behavioral decision and are, therefore, subjected to extensive variations over time. Therefore, habits as the determination of behavioral stability should be related more to theoretical variables, e.g., norms.

The results indicated that the farmers did not feel social pressure to display drought adaptation behaviors. Nevertheless, personal norms as the feeling of ethical commitment and responsibility for drought adaptation strategies had a significant effect on their intentions. Other researchers Klöckner (2013), Biesheuvel et al. (2021), Abadi and Kelboro (2022), Abid and Jie (2022) have reported a similar result. This finding points to the need for targeting people's normative influences when designing interventions in mechanisms of changing drought adaptation behaviors. In addition, farmers' attitude toward drought adaptation strategies reinforces their intention to apply them. This has been established in many studies (Richter and Klöckner, 2017; Mahdavi, 2021; Bagheri and Teymouri, 2022; Karimi and Ataei, 2022; Sereenonchai and Arunrat, 2022).

Objective and subjective barriers were also influential on the farmers' intentions and behaviors toward drought adaptation. The farmers felt that they had strong control over the application of drought adaptation strategies. In other words, they believed that they could better implement the measures required for the application of drought adaptation strategies. Other researchers also argue that the belief in the control over performing a task is important for behavior change, and the implementation of any environmental intervention should be based on people's abilities (Murwirapachena, 2021; Small and Maseyk, 2022; Tien et al., 2022; Yang et al., 2022). The other important component that affected the farmers' drought adaptation behavior was behavioral intention. Joanes et al. (2020), Wens et al. (2021), Sereenonchai and Arunrat (2022), and Yang et al. (2022) have reported that people's behaviors are determined by their intentions to do them. If farmers intend to use drought adaptation strategies, it will be more likely for drought adaptation behaviors to be exhibited by them.

5. Conclusion

The research aimed to develop a comprehensive model of farmers' adaptation behaviors toward drought. It used a combination of TPB, NAM, habits, objective situational factors, and constraints to describe drought adaptation behaviors. The results establish that a set of normative, habitual, situational, and intentional factors are involved in changing farmers' drought adaptation behaviors. Based on the relationships of the variables, to shape strong behavioral intention, personal norms should be institutionalized, whereas personal norms can reinforce farmers' habits of displaying adaptation behaviors. It should also be considered that personal norms are shaped by social norms and awareness of needs for the most part. Thus, it can be concluded that social pressure and an adequate understanding of needs shape personal norms in favor of drought adaptation. On the other hand, if farmers have a positive attitude toward drought adaptation strategies and believe their abilities to apply them and there are infrastructure, facilities, and equipment available, it can be predicted that their drought adaptation intentions and behaviors will be enhanced. These relationships indicate that to increase drought adaptation behaviors, farmers should understand the control of the behavior. It can also be concluded that besides the significance of the direct effects of such components as intention, attitudes, and norms on adaptation behaviors, the key role of mediating relationships should not be neglected in changing farmers' behavior, as these relationships play an underlying role in the process of farmers' behavior change toward drought adaptation.

This research identified personal norms and attitudes as two decisive factors in changing farmers' behavior toward drought adaptation. These two components can be strengthened by farmers who have successfully applied drought adaptation strategies as role models. Agricultural extension agents should also enhance farmers' awareness of needs in various ways, such as using social networks, making multilateral interactions with farmers, using demonstration techniques, etc. In addition, it is suggested that drought adaptation development programs aim to empower the farmers and facilitate their access to facilities. Providing these foundations, the objective and subjective barriers to applying drought adaptation strategies can be reduced. Regarding the development of research on farmers' adaptation to drought conditions, it is suggested to measure the effects of using drought adaptation strategies on farmers' resilience and viability.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

PA, HK, and ZK: conceptualization and validation. PA and HK: methodology. PA: software. ZK and PA: writing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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