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An integrated logical-ethical behavioral model for the analysis of water conservation decisions

Meysam Menatizadeh [a], Pouria Ataei [b], Hamid Karimi [c,*], Afshin Mottaghi Dastenaei [d]

[a] Department of Socio-Economic and Agricultural Extension Research, Lorestan Agricultural and Natural Resources Research and Education Center, Agricultural Research, Education & Extension Organization (AREEO), Lorestan, Iran
[b] Department of Socio-Economic and Agricultural Extension Research, Fars Agricultural and Natural Resources Research and Education Center, Agricultural Research, Education & Extension Organization (AREEO), Shiraz, Iran
[c] Department of Agricultural Extension and Education, Faculty of Agriculture, University of Zabol, Zabol, Iran
[d] Department of Political Geography, Faculty of Geographical Sciences, Kharazmi University, Tehran, Iran

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A B S T R A C T

Water scarcity due to climate change and drought has made the protection of water resources a priority in many countries, especially those in arid and semi-arid regions. While existing research has often examined either rational-cognitive or moral-normative drivers of pro-environmental behavior, this study contributes to the literature by integrating the Theory of Planned Behavior (TPB) and the Norm Activation Model (NAM) into a comprehensive "logical-ethical" behavioral framework. This integration enables a more holistic understanding of farmers' water conservation decisions by simultaneously accounting for cognitive, social, and moral dimensions. The empirical study was conducted in the Sistan Plain of Iran, an agriculturally important but water-stressed region. Data were collected through a structured questionnaire administered to 361 farmers selected via a multi-stage random sampling method. The data were analyzed using descriptive statistics and structural equation modeling ($AMOS_{24}$) to assess the causal relationships and test the proposed integrated model. The results demonstrated that the integrated logical-moral model was robust in predicting water conservation intention among farmers. The positive effect of moral norms on behavioral intention necessitates attention to the moral dimensions of water conservation decisions. Additionally, the effects of awareness of consequences, protective attitude, and past experience highlight the significance of logical and cognitive factors in shaping protective decisions. Based on the results, it is recommended, in the theoretical dimension, to apply integrated logical-moral models in protective behavior research. In the practical dimension, it is recommended to plan policy, educational, and executive interventions for the protection of water resources by relying on integrated approaches based on a combination of moral, cognitive, social, and normative measures that shape protection intentions and behaviors.

1. Introduction

In recent decades, water scarcity has led to various economic, social, and environmental challenges such as food insecurity and shortages, economic instability, extinction of some species, ecosystem destruction, and increased social conflicts, particularly in arid and semi-arid regions (Lako and Çomo, 2024; Savari et al., 2022; Nasiri et al., 2024a, 2024b). Iran, as a semiarid region in Asia, has been struggling with water crisis in recent decades. On the one hand, climate change and drought have caused a decrease in annual rainfall, resulting in a shortage of surface water, a decrease in aquifer levels, and the drying up of aqueducts (Menatizadeh et al., 2024; Maghrebi et al., 2023; Valizadeh et al., 2023). On the other hand, centralized, inappropriate, and top-down water policies, along with farmers' competition in the use of water resources, have faced Iran with a mega challenge in water resources as severe water stress, water bankruptcy, or water crisis (Nouri et al., 2023; Barati et al., 2023; Shahangian et al., 2021a; Ketabchy, 2021).

Tackling the water crisis requires addressing its fundamental root cause—the persistent imbalance between water supply and demand. Climate change and recurrent droughts have significantly reduced

* Corresponding author.
E-mail addresses: m.menatizadeh@areeo.ac.ir (M. Menatizadeh), p.ataei@areeo.ac.ir (P. Ataei), karimihamid@uoz.ac.ir (H. Karimi), a.mottaghi@khu.ac.ir (A. Mottaghi Dastenaei).

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rainfall and surface water availability, while groundwater depletion and the drying of aqueducts have further exacerbated the problem. At the same time, centralized and top-down water policies, coupled with increasing competition among farmers for limited resources, have intensified pressures on water systems in Iran. In this context, ensuring the efficient and sustainable use of water resources has become not only a national priority but also a fundamental global objective aligned with the Sustainable Development Goals (SDGs). To achieve this, a paradigm shifts from supply-side strategies—focused mainly on expanding water availability—to demand-side management has been widely recognized as a basic pillar of sustainable water governance. This approach emphasizes optimizing existing resources, improving efficiency, and reducing waste, particularly in the agricultural sector, which consumes the largest share of freshwater. Within this paradigm, water conservation stands as the cornerstone of demand-side management, serving as a critical strategy for safeguarding resources for both present and future generations. Therefore, sustainable water management in agriculture must give special attention to promoting conservation-oriented practices, which are indispensable for enhancing resilience, ensuring food security, and maintaining ecological balance in arid and semi-arid regions like Iran.

Shifting from water supply management to water demand management, as a basic pillar of sustainable water management has highlighted water conservation, efficiency, and the optimization of existing water resources strategies (Shahangian et al., 2021b, 2022; Mosavian et al., 2023; Danesh-Pajooh et al., 2025). Based on water demand management paradigm, optimal and efficient use of water resources to ensure sustainable access to water is one of the fundamental sustainable development goals in the world (Singha et al., 2022; Palamuleni et al., 2024; Rashid et al., 2024; Zakir-Hassan et al., 2024). In other words, the causes of environmental issues such as water scarcity, which threaten human life, ecosystems, and socio-ecological development, can be significantly traced to human behavior, despite their undeniable environmental origins like climate change (Mohammadi et al., 2024; Limke et al., 2025; Khorashadi Moghaddam et al., 2025).

Developing environmental psychology provides a powerful framework for understanding how human behavior shapes environmental outcomes and, in particular, how farmers' decisions affect water conservation. While environmental problems such as water scarcity have undeniable physical and climatic roots, they are fundamentally mediated by human behavior (Steg & Velk, 2009; Prasad et al., 2025; Kamyabi Azar et al., 2025). Farmers' choices regarding irrigation methods, consumption habits, and adoption of water-saving practices directly determine the sustainability of agricultural water use. From this perspective, environmental psychology plays a critical role in identifying the psychological, social, and moral determinants that influence such behaviors. By analyzing attitudes, norms, perceived control, and moral commitments, researchers can better explain why some farmers adopt conservation practices while others do not. This understanding is not merely theoretical; it is essential for designing and implementing policies aimed at promoting sustainable practices. Without attention to the behavioral and psychological dimensions of farmers' decisions, governmental and institutional interventions risk remaining ineffective. Therefore, placing farmers' decision-making processes and their underlying determinants at the center of research is a prerequisite for advancing sustainable water management strategies in arid and semi-arid regions like Iran.

Global agriculture sector accounts for more than 70 % of freshwater withdrawals. In Iran, despite having limited water resources, around 90 % of the water resources consumes by agriculture. So, farmers, due to their decision-making role in water use on farms, have a critical influence regarding water use. In fact, without farmers' willingness to water conservation, government policies and programs to preserve water resources have no success (Zobeidi et al., 2022; Torabi et al., 2025b). Therefore, it is crucial to promote protective behaviors, such as conserving water, modifying water consumption habits, and understanding the factors that shape protective or non-protective intentions and behaviors (Baah et al., 2024; Hua et al., 2025).

Developing environmental psychology and applying psychological theories in understanding and explaining farmers' water conservation behaviors can help to identify the psychosocial factors that drive pro-environmental actions. In this regard, the researchers have studied the effects of psychological factors on environmental activities like water conservation using various models and theories (Badsar et al., 2023; Hashempour et al., 2018; Deogaonkar et al., 2024). Numerous studies have highlighted that water scarcity is not only a technical or climatic issue but also fundamentally rooted in human behavior and decision-making (Steg and Vlek, 2009; Gkargkavouzi et al., 2019; Baah et al., 2024). Previous research has demonstrated that individual attitudes, perceived behavioral control, and social norms significantly shape the adoption of water conservation practices (Ajzen, 1991; Wang et al., 2019; Maleki et al., 2025). At the same time, moral and normative factors—such as personal norms, awareness of consequences, and ascription of responsibility—have been found to play a decisive role in motivating pro-environmental behaviors that go beyond cost–benefit considerations (Schwartz, 1977; Rezaei et al., 2019a,b,c; Surira et al., 2025).

Psychological research on environmental conservation in general, and water conservation in particular, is an arena for the confrontation of two paradigms in environmental behavior studies. The first paradigm, which has a longer history, is based on rational and economic analyses and considers cognitive factors and cost-benefit analyses in accounting for environmental intentions. Ajzen's (1991) Theory of Planned Behavior (TPB) and Rogers's (1983) Protection Motivation Theory are two distinguished examples of these rational and economic theories. In this view, humans are seen as rational, profit-seeking, and voluntary actors within rules and regulations when dealing with the environment. Thus, it is futile to expect them to observe ethical rules that are incompatible with their personal benefits (e.g., dedication, justice, and the rights of other animals). The second paradigm relies on ethical analyses and seeks value and moral factors in accounting for environmental intentions and behaviors. Two prominent theories are Schwartz's (1973) Norm Activation Model (NAM) and Stern's (2000) Value-Belief-Norm Theory. In this view, humans are considered ethical entities who feel responsible for protecting the environment and are committed to observing the rights of other inhabitants of the Earth. Sometimes, they exhibit environmental behaviors that have no perceived personal benefit or profit (Valizadeh et al., 2018).

Since, environmental and water resource conservation is not merely a rational action influenced by cognitive variables; but also involves normative dimensions influenced by moral commitment (Sang et al., 2020; Rezaei et al., 2019a,b,c); Therefore, this research aims to integrate TPB and NAM to provide a comprehensive analysis of farmers' protection decisions. Integrating the TPB and NAM creates a more comprehensive framework by combining rational-cognitive factors (like perceived behavioral control, attitude, and social pressure) and moral-normative factors (like personal norms, ascription of responsibility) to predict water conservation willingness. In the other words, this integration includes internal moral motivations (e.g., personal norms, ascription of responsibility, awareness of consequences) and external social influences (e.g., subjective norms, perceived behavioral control) to explain pro-environmental behaviors comprehensively.

Recent studies have increasingly moved toward integrating cognitive–rational and moral–normative approaches in order to provide a more comprehensive understanding of pro-environmental behaviors. Despite this progress, several gaps remain. First, empirical applications of integrated TPB–NAM models in the specific context of agricultural water conservation—particularly in highly water-stressed regions—are still limited. Much of the existing research focuses on general environmental behaviors or other agricultural practices, leaving water-saving behaviors underexplored. Second, while past behavioral experiences and habits are known to influence future pro-environmental intentions (Klöckner and Blöbaum, 2010), these factors have often been neglected in previous water conservation studies. Finally, there is limited empirical evidence from developing countries such as Iran, where structural constraints, institutional inefficiencies, and cultural norms may interact with cognitive and moral factors in unique ways.

Empirical applications of such integrated frameworks in the field of agricultural water management remain limited, particularly in water-scarce regions of developing countries. Addressing this gap, the present study aims to empirically test an integrated rational–moral model that combines constructs from TPB and NAM to explain farmers' intentions toward water conservation. While the contribution is primarily empirical—providing evidence on farmers' decision-making in the Sistan Plain of Iran—it also has a methodological dimension by demonstrating the value of combining TPB and NAM in a single framework. This dual contribution advances both the theoretical discourse and practical policy implications for sustainable water management.

To what extent does an integrated logical–ethical behavioral model, combining the Theory of Planned Behavior (TPB) and the Norm Activation Model (NAM), explain farmers' intentions to adopt water conservation practices in the Sistan Plain of Iran?

The present research adopts an integrated approach composed of rational and moral models to explain Persian farmers' water conservation decisions. This approach attempts to provide a comprehensive analysis of farmers' protective decisions by identifying moral, cognitive, normative, and structural factors that influence water conservation intentions. Thus, we first explore the application of TPB and NAM in environmental protection research and then describe the integrated rational-moral model that constitutes the theoretical framework of the field research.

2. Theoretical framework

2.1. The Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB) (Ajzen, 1991) is an extension of the Theory of Rational Action (TRA) (Popa et al., 2019; Liao and Fang, 2019; Gheitarani et al., 2024; Wang et al., 2019). With a rational view of behavior, TPB emphasizes the importance of cognitive variables in explaining human behaviors. TPB has been extensively applied to understand a wide range of human behaviors, including pro-environmental actions, due to its emphasis on cognitive determinants and the rational decision-making process (Wang et al., 2019; Gkargkavouzi et al., 2019). In the context of environmental psychology, TPB assumes that individuals act based on deliberate considerations of available information, weighing the expected outcomes of their actions against personal and social influences.

According to TPB, human behavior is primarily influenced by the intention to perform the behavior. Behavioral intention, which refers to an individual's willingness and effort to perform the behavior (Grilli and Notaro, 2019), is itself affected by three factors: attitude, subjective norms, and perceived behavioral control (PBC) (Wang et al., 2020). Attitude refers to an individual's positive or negative evaluation of the target behavior (Ajzen, 1991; Li et al., 2020), subjective norms refer to perceived social pressure to perform the target behavior (Zhang et al., 2017; Asadiof et al., 2025; Batool et al., 2024), and perceived behavioral control is the individual's perception of the ease or difficulty of performing the target behavior (Hsu et al., 2017; Savari et al., 2025). Therefore, the first and second hypotheses of this research, which are derived from TPB are as follows.

H1. Attitude toward water conservation is positively related to behavioral intention to perform water conservation behaviors.

H2. Perceived behavioral control (PBC) is positively related to behavioral intention to perform water conservation behaviors.

Since its development, researchers worldwide have used TPB to explain human behavior in protecting the environment. Applications of TPB in environmental and agricultural research demonstrate its utility in understanding behaviors such as renewable energy adoption (Yazdanpanah et al., 2015, 2025), farmers' intention towards conservation agriculture (Tama et al., 2021); Water conservation (Palamuleni et al., 2024), treated wastewater reuse in irrigation (Savari et al., 2025), and water conservation practices in farming communities (Maleki et al., 2025). Following critiques of TPB for neglecting altruistic and moral incentives in explaining environmental behaviors (Rezaei et al., 2019a, b,c), many researchers have focused on expanding it by including new variables, especially normative and ethical variables, to better capture environmental behaviors (Garay et al., 2019; Anbari et al., 2024). Consequently, TPB has been integrated with other theories such as the Value-Belief-Norm (VBN) Theory (Batool et al., 2024), the Norm Activation Model (NAM) (Danesh-pajooh et al., 2025; Duong et al., 2024; Zhu et al., 2024a,b; Fan and Ye, 2025; Muthukumari et al., 2024; Rezaei et al., 2019a,b,c), and the Protection Motivation Theory (Wang et al., 2019) to enhance its explanatory power in environmental contexts. These integrations address the fact that individuals may engage in conservation behaviors not solely for self-interest or rational cost–benefit reasons, but also due to internalized moral obligations, environmental values, and habitual practices (Gkargkavouzi et al., 2019). These studies reveal that while cognitive factors such as attitudes and perceived control are important, their influence is often enhanced when combined with moral norms, awareness of environmental consequences, and social identity.

2.2. Normative Activation Model (NAM)

According to the Normative Activation Model (NAM) (Schwartz, 1973; 1977; Schwartz and Howard, 1984), social behaviors such as pro-environmental behaviors are shaped by personal norms, especially when individuals are adequately aware of the consequences of their behaviors and feel responsible for them (Schwartz, 1997). Personal norms, which represent self-expectations for certain behaviors in specific conditions (Schwartz, 1973), are the initial incentives for pro-environmental behaviors (Surira et al., 2025). They are defined as "the feeling of moral commitment to perform or avoid a certain behavior" (Schwartz and Howard, 1981) and are often described as sin avoidance (Schwartz, 1973). The relationship between social norms and personal norms is also significant. According to Schwartz (1977), personal norms differ from social norms or standards accepted by the community, as they are internalized moral obligations rather than externally imposed expectations. According to NAM, personal norms—defined as internalized moral obligations—are generally derived from social norms through a gradual process of socialization (Schwartz, 1977; Kaiser and Scheuthle, 2003). Unlike social norms, which influence behavior through external social pressure (Ajzen, 1991; Zhang et al., 2017), personal norms have greater stability over time and across contexts because they are internalized and less susceptible to change when external conditions shift (Krettenauer and Lefebvre, 2021; Valizadeh et al., 2020; Song et al., 2023). This distinction is crucial for understanding NAM's explanatory power in predicting consistent pro-environmental behaviors, even in the absence of strong social pressure.

Schwartz (1977) posits that personal norms are a sense of moral commitment; additionally, a part of personal norms is used as moral norms in various environmental studies. Some studies have found that moral norms have a direct effect on environmental intentions and behaviors. But some researchers believe that moral norms indirectly shape environmental intentions and behaviors by influencing environmental attitudes (Botetzagias et al., 2015; Borychowski et al., 2025; Czyżewski et al., 2025; Shahangian et al., 2024; Valizadeh et al., 2021; Krettenauer and Lefebvre, 2021; Kaiser, 2006; Kaiser and Scheuthle, 2003). Therefore, the third and fourth hypotheses of the research are as follows.

H3. Moral norms are positively related to behavioral intention to perform water conservation behaviors.

H4. Moral norms are positively related to attitude toward water conservation.

According to Schwartz (1977), the effect of moral norms or the sense of moral commitment on behavior depends on their activation by awareness of behavior consequences for the community and the acceptance of responsibility by the individual. Awareness of consequences is discussed in environmental research in three forms: the positive consequences of adopting environmental behaviors (Rezaei et al., 2019a,b,c; Sajid et al., 2022a), the negative consequences of not adopting environmental behaviors (Rezaei et al., 2019a,b,c; Sajid et al., 2022b), and the negative consequences of adopting environmentally destructive behaviors (Esfandiar et al., 2020; Han et al., 2019). According to NAM, awareness of consequences activates personal norms and fosters a sense of moral commitment to adopt pro-environmental behaviors and avoid environmentally destructive behaviors (Schwartz, 1977; Steg and De Groot, 2010; De Groot and Steg, 2009a; Surira et al., 2025). If individuals are unaware of the consequences of their behavior on the environment, they are unlikely to feel morally committed to adopting or avoiding the behavior (Han et al., 2019; Rezaei et al., 2019a, b,c). Therefore, promoting pro-environmental behaviors requires raising people's awareness of the consequences of their behaviors on the environment (Surira et al., 2025). So, fifth hypothesis is as follows.

H5. awareness of consequences is positively related to moral norms.

In addition to awareness of consequences, the ascription of responsibility for the implications of personal behavior for the environment (Sigit et al., 2019; Kaiser & Shimoda, 1999) is also involved in activating personal norms (Schwartz, 1977; Steg et al., 2014). It may be the case that some people are aware of the consequences of their behaviors on the surrounding environment, but they take no environmental action due to indifference or irresponsibility (Hansla et al., 2008). Therefore, the coexistence of awareness of consequences and ascription of responsibility is necessary for the activation of pro-environmental norms (Abdul Wahid et al., 2022; Liobikienė and Juknys, 2016; Steg & De Groot, 2009b). These two variables have also been emphasized in the Value-Belief-Norm (VBN) theory in accounting for pro-environmental behaviors (Stern et al., 1999; Stern, 2000). Various researchers conducted their study using NAM in pro-environmental behavior (Hallaj et al., 2021a,b), conservation agriculture (Karim et al., 2024), Water Conservation Behavior (Torabi et al., 2025a). Sixth hypothesis which empathizes the effect of awareness on responsibility is as follows.

H6. awareness of consequences is positively related to ascription of responsibility.

2.3. Integrated rational-moral model

There are serious doubts about the efficiency of TPB in accurately and comprehensively explaining protective intentions and behaviors. According to some researchers, environmental conservation, in general, and water conservation, in particular, are not merely rational and logical decisions; they also have moral dimensions (Landon et al., 2017; Tayyebi et al., 2025; Conner and Armitage, 1998). These actions require altruistic incentives and people's dedication in order to ensure the availability of resources for future generations and other components of nature (Kiatkawsin et al., 2020). Therefore, researchers who emphasize the moral dimension of pro-environmental behaviors (Landon et al., 2017; Ramey et al., 2025) have focused on enhancing TPB by including moral variables, such as moral norms (van der Werff and Steg, 2015; Kaiser, 2006). Others have used normative models, e.g., NAM, to analyze protective behaviors (Song et al., 2023; Lee et al., 2023; Connor and Assaker, 2022; Wang et al., 2022; Steg and De Groot, 2010). Some researchers have even attempted to integrate TPB and NAM (Danesh-Pajooh et al., 2025; Savari et al., 2023a,b; Esfandiar et al., 2021; Meng et al., 2020; Rezaei et al., 2019a,b,c). Some researchers have also attempted to simultaneously consider the logical and ethical aspects of environmental behaviors by adding moral values and norms to the rational behavioral models like TPB (Shahangian et al., 2024; Nasiri et al., 2024b; Yazdanpanah et al., 2016).

Various studies on environmental issues have been conducted based on the combined TPB and NAM models. Researchers have used this integrated framework to examine human pro-environmental behaviors and intentions. Several recent studies have sought to enhance the explanatory power of the Theory of Planned Behavior (TPB) by integrating it with other frameworks, particularly the Norm Activation Model (NAM). This integration has been shown to improve predictions of pro-environmental behaviors by combining rational–cognitive determinants with moral–normative factors (Rezaei et al., 2019a,b,c; Setiawan et al., 2020; Savari et al., 2023a,b; Zhu et al., 2024a,b). These findings suggest that applying an integrated TPB–NAM model offers a more comprehensive framework for understanding water conservation behaviors, particularly in contexts where both social and moral commitments influence decision-making.

After integrating the two behavioral models, some relationships are formed between the variables of the integrated model, which are discussed below. First, there is a normative sequence, which consists of a chain of social norms, responsibility, moral norms, and behavioral intention to perform water conservation behavior. Subjective norms or social pressure in TPB are social standards which guide people to determine whether a specific behavior is socially right or wrong. Personal norms or moral norms in NAM express individual values which accepted by people over time form different sources especially social norms (Menatizadeh et al., 2024; Nechat et al., 2025). In fact, moral norms, as personalized or internalized social obligations, often derived from and affected by broader social norms in community (Schwartz, 1977). Social pressure precedes moral norms because social norms often guide a person to determine his belief as to whether the behavior is right for himself/herself (Bamberg et al., 2007). So, the social pressure– moral norms link, as a normative sequence, integrates two important concepts of TPB and NAM. But, according to Schwartz (1977), the effect of moral norms on behavior depends on their activation by the acceptance of responsibility by the individual. In other words, the relationship between social pressure and moral norms is mediated by ascription of responsibility. It means that moral norms related to water conservation which derived from relevant social norms require an individual's sense of responsibility to protect water resources to be activated. Also, accepting responsibility seems logical when the individual has the necessary control over the behavior. Otherwise, behaviors that are beyond the individual's control do not create responsibility for him/her. So, seventh, eighth and ninth hypotheses are as follow.

H7. social pressure is positively related to ascription of responsibility.

H8. ascription of responsibility is positively related to moral norms.

H9. perceived behavioral control (PBC) is positively related to ascription of responsibility.

Second, there is a sequence between awareness of outcomes, and attitude, and behavioral intention. It is anticipated that awareness of consequences of water-related behaviors contributes to the formation of attitudes toward water conservation. That is, a person who is highly conscious of positive outcomes of conservation of water resources (e. g., reduction in pollution, less exploitation of natural resources, and a better environment for the next generation), will have a more favorable attitude toward water conservation (Park and Ha, 2014). So, tenth hypothesis is as follows.

H10. awareness of consequences is positively related to attitude toward water conservation.

In addition to the TPB and NAM variables, the theoretical framework also includes behavioral experience regarding water resource protection. Social learning theories (Bandura, 1986) suggest that direct experience or observation of similar behaviors facilitates the internalization of positive behaviors. An individual's experience in performing protective behaviors can therefore influence their subsequent behavioral intentions. In behavioral prediction models, the variable of previous experience or behavioral history has not been considered as a predictive factor for future behaviors. While it seems logical that an individual's past experiences strengthen or weaken behavioral tendencies in the future. Although this variable has not been explicitly included in environmental behavior models so far; some behavioral models like the ecological behavior model introduced by Klöckner and Blöbaum (2010) named a Comprehensive Action Determination Model (CADM), have referred to a predictive variable called habitual processes(including history of repetition and automaticity), which implicitly indicates the importance of an individual's habits and experiences in human future environmental orientations, intentions, and behaviors. Despite the significance of this variable, it has been overlooked in important protective behavior models, such as TPB and NAM. Thus, this research incorporates it into the integrated rational-moral model of water conservation. Two related hypotheses are as follow (see Fig. 1).

H11. past experience is positively related to behavioral intention to perform water conservation behaviors.

H12. past experience is positively related to attitude toward water conservation.

3. Methodology

3.1. Case study

This research was conducted in the Sistan Plain, located in the Sistan and Baluchistan province of southeastern Iran. The region is characterized by an arid climate, frequent droughts, declining annual precipitation, and extensive reliance on agricultural activities for livelihoods. Agriculture in this area is particularly water-intensive, and unsustainable irrigation practices have exacerbated water scarcity, threatening both rural livelihoods and the long-term sustainability of local ecosystems.

The significance of studying this case lies in its dual importance: (1) the Sistan Plain is one of the most water-stressed regions in Iran, making water conservation a vital necessity for agricultural and rural resilience; and (2) the agricultural sector consumes the largest share of available water resources, meaning that farmers' behaviors and decision-making processes directly determine the prospects of sustainable water management. Thus, the Sistan Plain provides a critical context for analyzing the behavioral, social, and moral factors influencing farmers' water conservation decisions.

3.2. Survey design

This research is an applied study in terms of purpose and a descriptive-causal study in terms of data analysis techniques. Data were collected using a survey technique. The research domain was the Sistan Plain in Sistan and Baluchistan province. The population comprised all farmers affected by drought, estimated to be 6000 farmers. A sample was taken using the random multi-stage clustering technique, with a sample size of 361 farmers based on Krejcie and Morgan's (1970) table. Data were collected using a research-designed questionnaire.

To ensure the quality of the measurement instrument, both content and face validity were examined. The content validity of the questionnaire was assessed by a panel of subject-matter experts who reviewed the items for relevance, clarity, and coverage of the construct domains. In addition, the face validity was evaluated by distributing the questionnaire to a small sample of farmers similar to the target respondents. They evaluated the questionnaire items based on clarity, transparency, coverage of all issues, and alignment with the research goals. After implementing the recommended corrections, the final questionnaire was confirmed by the panel and put into use. The reliability of the questionnaire was assessed in a pilot study on a small sample of the target population. Data collected were analyzed using Cronbach's alpha. The results revealed that all constructs had suitable internal consistency and reliability. Specifically, Cronbach's alpha shows the suitability of the measurement instrument if it is greater than the standard value of 0.7 for all constructs. The research variables were measured on a five-point Likert scale from 1 ("completely disagree") to 5 ("completely agree"). This scale allows for precise assessment of participants' attitudes, beliefs, and behaviors.

The dependent variable was farmers' intention to apply water protective measures. Behavioral intention is defined as an individual's intention to demonstrate certain behaviors that contribute to the protection of water resources, such as reducing water consumption, utilizing water-saving equipment, and educating others. This variable was assessed individuals' intentions or plans to engage in water conservation behaviors. The independent variables included attitudes towards water conservation, social pressure, perceived behavioral control, past experience, moral norms, ascription of responsibility, and awareness of consequences.

Awareness of consequences was defined as individuals' recognition of the positive or negative effects of their behaviors on water resources, the environment, and society. This variable was measured assessing participants' knowledge and understanding of the consequences of improper water consumption or water conservation. Attitude refers to individuals' overall perspective on the importance of water resource protection and its pros and cons. This variable was measured regarding participants' positive or negative opinions about water conservation measures, such as reducing water use or using water-saving technologies. Social pressure refers to the effect of social groups, family, friends, or society on individuals' behavior regarding water conservation. This variable was evaluated representing others' expectations and

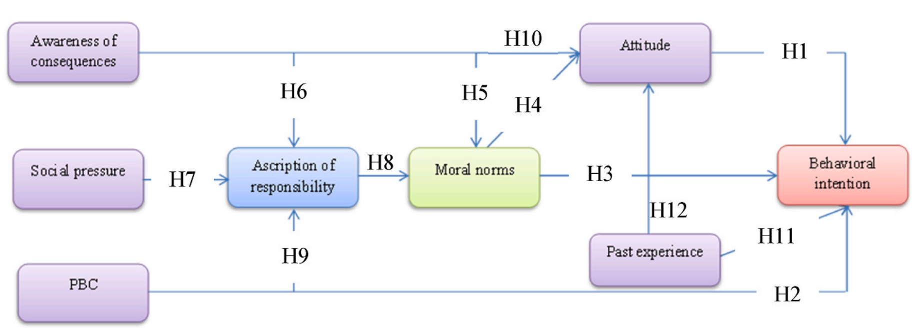

Fig. 1. The theoretical framework of the research.

individuals' concerns about social judgment. Perceived behavioral control is individuals' belief in their ability to perform water conservation behaviors, such as reducing water consumption or using modern irrigation methods. This variable included factors like ease or difficulty of operationalizing behaviors and a sense of self-efficacy.

Ascription of responsibility is defined as individuals' sense of responsibility for protecting water resources and their role in improving or degrading these resources. This variable was measured regarding participants' intention to take responsibility for water management measures. Moral norms are individuals' beliefs and moral values regarding water conservation as a moral and human duty. This variable was determined about the sense of moral commitment to contribute to water conservation and avoid wastage. Past experience means individuals' prior experiences with water conservation activities and behaviors, such as participation in water campaigns, relevant education, or the use of water-saving equipment. This variable was evaluated about the frequency and type of prior experiences.

3.3. Data analysis

The SPSS (win26) software package was used for preliminary statistical calculations on the collected data, while AMOS (ver. 24) was used for advanced analyses and Structural Equation Modeling (SEM). Data analysis included the calculation of descriptive indices, such as mean and standard deviation (SD). Data analysis was performed using the SEM approach, which enables the simultaneous examination of multiple relationships among observed and latent variables. SEM is particularly appropriate for testing complex behavioral models such as the integrated TPB–NAM framework, as it combines both measurement and structural components within a single comprehensive analytical procedure.

The measurement model specifies how observed indicators represent underlying latent constructs, allowing researchers to evaluate the reliability and validity of the measurement scales. This component was assessed using Confirmatory Factor Analysis (CFA), through which the factor loadings, composite reliability (CR), average variance extracted (AVE).

The structural model, on the other hand, evaluates the hypothesized causal relationships among the latent variables based on theoretical assumptions. In this study, the structural model tested the direct and indirect effects among the TPB–NAM constructs on farmers' intentions toward water conservation. Model fit was assessed using several goodness-of-fit indices, such as the Chi-square/df ratio, Comparative Fit Index (CFI), Root Mean Square Residual (RMR), and Root Mean Square Error of Approximation (RMSEA). Acceptable values of these indices indicated an adequate model fit.

By incorporating both the measurement and structural models, SEM provides a powerful and rigorous tool for evaluating complex theoretical frameworks, allowing for a more comprehensive understanding of the behavioral and psychological factors influencing water conservation decisions.

All procedures, from instrument design to final analysis, aimed to ensure the accuracy, credibility, and dependability of the results and provide a scientific basis for drawing conclusions about water conservation behaviors.

4. Results

4.1. Descriptive analysis results

The results of exploring the farmers' demographic and agronomic characteristics revealed that 93.5 % were male, while only 6.5 % were female, reflecting the dominance of males in agricultural activities. This may be associated with the physical and social nature of this profession. Also, 92.2 % were married, whereas 7.8 % were single. This high proportion of married farmers may show the supportive role of families in agricultural occupations. The farmers were, on average, 52.03 years old (SD = 10.66 years), showing that they are relatively old and younger people exhibit less enthusiasm for this profession. The average farming experience was found to be 29.81 years (SD = 11.6 years), highlighting their extensive experience and expertise. In terms of occupation, 67.7 % were engaged in crop farming, 17.5 % in horticulture, and 14.8 % in animal farming. This data indicates that crop farming remains the primary occupation among farmers in the Sistan Plain. In terms of educational level, 15.5 % were illiterate, 18.8 % were intermediate school graduates, 15.7 % had high school diplomas, 10.7 % had associate degrees, 29.5 % had bachelor's degrees, 7.7 % had master's degrees, and only 2.1 % had PhD degrees. This distribution suggests that despite educational diversity, a significant proportion of farmers are poorly educated, which can be challenging for the utilization of modern technologies.

Regarding land ownership, 89.7 % were owners of their farms and orchards, while 10.3 % were tenants or sharecroppers. The average land area was 7.64 ha. On average, 5.31 ha were irrigated by the flooding technique, 1.37 ha by the drip system, and 0.96 ha by the sprinkler system. This indicates the extensive use of traditional irrigation methods, which are characterized by high water waste. The farmers' access to agricultural machinery revealed that 16.8 % had tractors, 44.5 % had plows, 24.8 % had disc harrows, 0.96 % had combine harvesters, 20.6 % had seeders, 29 % had fertilizer spreaders, and 36.1 % had pesticide sprayers, reflecting their unequal access to advanced equipment that can influence their efficiency. Furthermore, the farmers had, on average, attended 1.01 educational courses in water conservation over the last year. Hence, raising awareness of water resources requires significant efforts. Data analysis indicates that farming in Iran necessitates adopting policies for recruiting younger labor, increasing education, and providing access to advanced technologies. Applied training courses and the adoption of modern irrigation methods can improve agricultural productivity and sustainability.

4.2. The status of the variables in the theoretical framework

The variables in the theoretical framework were examined using their mean, standard deviation, and coefficient of variation. The mean represents the average scores for each variable, where a higher mean indicates greater significance or a higher level of the variable among respondents. The standard deviation reflects data dispersion; a lower standard deviation signifies more concentrated data. The coefficient of variation, calculated by dividing the standard deviation by the mean, shows the normalization of data dispersion relative to the mean. A lower coefficient of variation implies greater stability of the variable. Accordingly, the variables were ranked based on their importance and stability using their coefficients of variation (Table 1).

Table 1
The description of the research variables.

Variable	Mean	Standard deviation	Coefficient of variation	Rank
Awareness of consequences	25.27	5.71	0.226	4
Attitude	20.94	5.13	0.245	6
Social pressure	20.47	3.63	0.177	3
Perceived behavioral control	19.63	4.98	0.254	8
Ascription of responsibility	11.50	2.75	0.239	5
Behavioral intention	75.03	12.32	0.164	2
Moral norms	15.34	3.79	0.247	7
Past experience	92.34	7.35	0.080	1

4.3. Effect of independent variables on farmers' behavioral intention

4.3.1. Estimation of the measurement model

Table 2 presents the results of the measurement model used to evaluate the reliability and validity of the study constructs. As shown in the table, all standardized factor loadings range between 0.50 and 0.99, indicating strong correlations between the observed indicators and their corresponding latent variables, and confirming satisfactory convergent validity of the measurement instrument. Cronbach's alpha coefficients for all constructs exceed the threshold value of 0.70, demonstrating high internal consistency and reliability of the questionnaire. Similarly, the Average Variance Extracted (AVE) values are greater than 0.50 for most constructs, confirming adequate convergent validity. Composite Reliability (CR) values also exceed 0.77 across all variables, reflecting the overall stability and dependability of the measurement scales. Moreover, the model fit indices—RMSEA (ranging from 0.04 to 0.07), GFI, IFI, and CFI (all above 0.90)—indicate that the measurement model has achieved a good level of fit. Items with weak factor loadings (less than 0.50) were appropriately removed to enhance the overall accuracy and model fit. Therefore, the results in Table 2 confirm that the measurement instrument used in this study possesses acceptable internal reliability, convergent validity, and overall model fitness, making it suitable for subsequent structural analysis.

4.3.2. Estimation of the structural model

Before examining the impact of the independent variables on farmers' behavioral intentions, the model fit was evaluated using the structural model's fit indices to assess its quality and appropriateness. These indices indicate how well the proposed model aligns with the observed data. In the integrated model, the likelihood ratio Chi-square (χ^2) was estimated at 0.02, with a value closer to zero indicating a negligible difference between the observed covariance matrix and the covariance matrix estimated by the model. Thus, a value of 0.02 demonstrates the model's good fit. Regarding the normed chi-square (χ^2/df), values less than 3 (or, in some sources, less than 5) signify an acceptable fit. Our model's value of 2.26 confirms the structural model's good fit. The Root Mean Square Residual (RMR) shows a good fit if it is less than 0.08. In our study, it was calculated to be 0.06, indicating a small mean difference between the observed and predicted covariance matrices, and hence, the model's robustness.

Concerning the Root Mean Squared Error of Approximation (RMSEA), values less than 0.06 show an excellent fit. For our structural model, the RMSEA was 0.06, suggesting a nearly excellent fit. The Goodness-of-Fit Index (GFI) indicates a good fit with values greater than 0.9. Our research recorded a GFI of 0.93, demonstrating good consistency of the structural model with the data. The Incremental Fit Index (IFI) must exceed 0.9 to establish a good fit. In our research, it was 0.99, implying the model's excellent fit. Finally, the Comparative Fit Index (CFI) was calculated to be 0.99, showing the model's excellent fit, as it needs to be greater than 0.9 for a good fit and greater than 0.95 for an excellent fit (Table 3).

The results of the model comparison (Table 3) indicate that all three tested models achieved acceptable levels of fit according to widely recommended thresholds. Among the models, the integrated TPB–NAM framework shows superior performance, as indicated by its higher incremental fit indices. This suggests that extending the TPB with NAM constructs not only provides a theoretically richer framework but also improves the statistical properties of the model. In contrast, while the standalone TPB and NAM models individually demonstrated acceptable fit, their explanatory strength is comparatively lower. The comparison thus confirms that the integration of rational (TPB) and moral (NAM) dimensions yields a more comprehensive and robust model for explaining farmers' water conservation intentions.

According to the path analysis results, moral norms have a strong and significant effect on attitudes toward water conservation ($\beta = 0.653$; $P < 0.01$). This indicates that when farmers accept the moral norms for water conservation, they develop more positive attitudes toward water conservation behaviors, thus supporting hypothesis 1. Additionally, the results reveal that past experience ($\beta = 0.004$; $P < 0.23$) and awareness of environmental consequences ($\beta = 0.003$; $P < 0.65$) do not significantly influence farmers' attitudes toward water conservation. In other words, these variables alone cannot alter farmers' attitudes toward water conservation, thus refuting hypotheses 2 and 3.

Based on the results, a positive attitude toward water conservation behaviors significantly influences farmers' behavioral intentions ($\beta = 0.469$; $P < 0.01$), while perceived behavioral control (e.g., access to resources or facilities) does not have a significant effect ($\beta = 0.008$; $P < 0.74$). Hence, hypothesis 4 is supported, but hypothesis 5 is refuted. On the other hand, both moral norms ($\beta = 0.473$; $P < 0.01$) and past experience ($\beta = 0.07$; $P < 0.01$) positively and significantly influence farmers' behavioral intentions, with moral norms being a stronger factor. Thus, hypotheses 6 and 7 are refuted.

As shown in Table 4, awareness of consequences positively and significantly influences the ascription of responsibility ($\beta = 0.11$; $P < 0.01$). This means that individuals who are more aware of environmental consequences are more likely to accept responsibility for protecting water resources. Furthermore, the ascription of responsibility is positively and significantly influenced by perceived behavioral control ($\beta = 0.56$; $P < 0.01$) and social pressure ($\beta = 0.122$; $P < 0.05$). Consequently, hypotheses 8, 9, and 10 are supported.

Lastly, moral norms are significantly influenced by awareness of environmental consequences ($\beta = 0.862$; $P < 0.01$) and the ascription of responsibility ($\beta = 0.049$; $P < 0.05$). This finding suggests that adequate awareness and a sense of responsibility strengthen moral norms regarding water conservation among farmers. Hence, hypotheses 11 and 12 are supported (Fig. 2).

The results presented in Table 4 highlight the predictive advantages of the integrated model compared to the standalone TPB and NAM models. While each of the individual models explained a considerable portion of the variance in farmers' behavioral intentions, the integrated TPB–NAM framework demonstrated substantially higher explanatory power. Specifically, by combining cognitive–rational factors with moral–normative constructs, the integrated model accounted for a larger share of the variance in intention. This improvement confirms that water conservation behavior cannot be fully understood by relying solely on rational choice mechanisms or moral obligations; rather, their synergistic combination provides a more comprehensive explanation. Such findings are consistent with recent studies (e.g., Danesh-pajooh et al., 2025; Duong et al., 2024; Zhu et al., 2024a,b; Fan and Ye, 2025; Rezaei et al., 2019a,b,c), which emphasize that integrated approaches outperform single-theory models in predicting pro-environmental behavior. Therefore, Table 4 provides empirical evidence that the integrated model is not only theoretically meaningful but also empirically superior in terms of predictive capability.

Squared multiple correlations (R^2) indicate the variance of the dependent variable accounted for by the independent variables. These values range from zero to one, with values closer to one indicating that the model has better explained the dependent variable. In this study, approximately 47.6 % of the variance in farmers' attitudes was accounted for by moral norms, past experience, and awareness of consequences, reflecting a close relationship and confirming that moral norms, past experience, and awareness of consequences are important variables in shaping farmers' attitudes toward water conservation. About 77.1 % of the variance in behavioral intention was captured by the variables of attitude, past experience, moral norms, and perceived behavioral control. This high value suggests that these variables are key determinants of farmers' intentions to conserve water resources. Additionally, 42 % of the variance in ascription of responsibility was explained by awareness of consequences, social pressure, and perceived behavioral control, indicating significant but moderate relationships between these variables. Finally, 72.7 % of the variance in moral norms was accounted for by awareness of consequences and ascription of

Table 2
The output of the measurement model.

Variables	Items	Standardized loading	α	AVE	CR	t-Value
Attitude toward Water Conservation (RMSEA = 0.04, GFI = 0.92, IFI = 0.94, CFI = 0.91)	Undertaking actions to conserve water resources is wise.	Dropped	0.77	0.51	0.80	–
	Engaging in water conservation activities is important and necessary.	0.70				Fixed
	Engaging in water conservation activities is beneficial.	0.80				8.15
	There is no cause for concern; nature is resilient enough to adapt to water scarcity.	0.70				8.53
	If water resources continue to be used in the same way, we will soon face a water crisis and disaster.	Dropped				–
	Farmers' activities are severely depleting water resources.	0.65				7.88
	Undertaking actions to conserve water resources is wise.	Dropped				–
Perceived behavioral control (RMSEA = 0.05, GFI = 0.91, IFI = 0.94, CFI = 0.91)	I have the financial resources to undertake water conservation measures.	0.95	0.85	0.57	0.86	Fixed
	I have the necessary knowledge and skills to conserve water resources.	0.99				41
	I am confident that if I want to, I can prevent water waste.	0.50				10.01
	I know what precautions to take to conserve water resources.	0.60				12.90
	I am not worried about water scarcity because I trust my ability to adapt to its impacts and consequences.	0.60				13.05
Awareness of consequences (RMSEA = 0.06, GFI = 0.93, IFI = 0.95, CFI = 0.90)	The current water shortage threatens my job and profession.	0.67	0.70	0.50	0.87	Fixed
	The current water shortage reduces my production and income.	0.75				11.10
	The current water shortage threatens the economic growth and development of the province and the country.	0.69				9.10
	The current water shortage threatens the well-being and comfort of my family and myself.	Dropped				–
	The current water shortage increases conflicts among farmers.	0.62				9.61
	The current water shortage threatens the lives of other living creatures.	0.67				9.04
	The current water shortage will restrict access to water for future generations (our children).	0.66				8.98
	The current water shortage contributes to climate change and rising temperatures.	0.90				9.54
Social pressure (RMSEA = 0.05, GFI = 0.95, IFI = 0.96, CFI = 0.93)	My family expects me to conserve water resources.	Dropped	0.81	0.77	0.91	–
	Other villagers and farmers expect me to conserve water resources.	0.99				Fixed
	The government and experts expect me to conserve water resources.	0.97				10.24
	People who are important to me and whom I take as role models expect me to conserve water resources.	0.98				10.19
	God, through religious teachings and the Prophet's traditions, has commanded us to conserve water resources.	Dropped				–
Ascription of responsibility (RMSEA = 0.06, GFI = 0.91, IFI = 0.92, CFI = 0.91)	Every member of society is responsible for conserving water resources.	0.50	0.71	0.55	0.77	Fixed
	Water conservation is the duty of the government (not farmers).	0.96				7.53
	Other villagers, especially large landowner farmers, should conserve water resources (not me).	0.70				9.69
Intention (Do you intend to do them in the future?) (RMSEA = 0.07, GFI = 0.92, IFI = 0.93, CFI = 0.90)	Membership in water user associations.	0.65	0.83	0.498	0.93	Fixed
	Membership in NGOs supporting water and environmental conservation.	0.65				9.58
	Participation in local/regional gatherings on water conservation.	0.60				8.90
	Participation in training and extension courses on water conservation.	0.76				8.74
	Using smart volumetric water meters.	Dropped				–
	Using modern pressurized irrigation systems (sprinkler, drip).	0.65				9.83
	Irrigating in the evening or at night to reduce evaporation.	0.65				9.53
	Using runoff and wastewater for farm irrigation.	Dropped				–
	Using fertilizers according to agricultural experts' advice.	Dropped				–
	Transferring water to the farm using water pipelines.	0.84				9.41
	Improving irrigation canals to reduce water losses (e.g., concrete lining, cleaning, weed removal).	0.77				8.8
	Planting drought-tolerant seed varieties.	0.81				9.13
	Planting water-intensive crops (such as rice, corn, watermelon, potato, etc.).	0.65				9.53
	Participating in water conservation projects of responsible organizations (Water Department, Agricultural Jihad, Natural Resources, Environmental Protection).	Dropped				–
	Complying with water laws and regulations (not digging unauthorized wells, not relocating wells without permission, following well license conditions).	0.79				9.21
	Reporting water violations (such as unauthorized well digging or river water extraction) to the Water Affairs Department or police/judiciary authorities.	0.65				9.91
	Informing officials (district governor, governor, parliament members, Friday prayer leader) about water scarcity conditions.	0.55				8.64
	Encouraging other farmers to conserve water resources.	Dropped				–

(*continued on next page*)

Table 2 (*continued*)

Variables	Items	Standardized loading	α	AVE	CR	t-Value
	Discouraging other farmers from illegal water exploitation practices (such as unauthorized well digging).	0.79				9.33
	Observing the environmental water rights of nature and other creatures.	Dropped				–
	Observing the water rights of downstream farmers.	Dropped				–
	Membership and activity in social networks (e.g., Eitaa, Soroush, Bale, WhatsApp, Telegram) on water conservation.	Dropped				–
	Creating occupational and income diversification and engaging in non-agricultural income sources.	Dropped				–
Moral norms (RMSEA = 0.04, GFI = 0.94, IFI = 0.95, CFI = 0.92)	I personally feel it is my duty to do whatever I can to conserve water resources.	0.71	0.76	0.50	0.80	Fixed
	When I feel unable to take action for water conservation, I feel guilty.	0.73				7.34
	When I waste water, I feel remorse.	Dropped				–
	Water conservation is a public and collective duty.	0.71				6.75
	If I protect water resources, I feel like a better person.	0.69				7.72
Past experience (Have you ever done the following actions?) (RMSEA = 0.07, GFI = 0.91, IFI = 0.91, CFI = 0.90)	Membership in water user associations.	0.51	0.83	0.496	0.93	Fixed
	Membership in NGOs supporting water and environmental conservation.	0.55				4.05
	Participation in local/regional gatherings on water conservation.	Dropped				–
	Participation in training and extension courses on water conservation.	0.70				5.46
	Using smart volumetric water meters.	0.55				5.20
	Using modern pressurized irrigation systems (sprinkler, drip).	0.60				5.38
	Irrigating in the evening or at night to reduce evaporation.	Dropped				–
	Using runoff and wastewater for farm irrigation.	Dropped				–
	Using fertilizers according to agricultural experts' advice.	0.76				5.51
	Transferring water to the farm using water pipelines.	0.74				5.50
	Improving irrigation canals to reduce water losses (e.g., concrete lining, cleaning, weed removal).	0.72				5.49
	Planting drought-tolerant seed varieties.	0.55				4.06
	Planting water-intensive crops (such as rice, corn, watermelon, potato, etc.).	0.71				5.47
	Participating in water conservation projects of responsible organizations (Water Department, Agricultural Jihad, Natural Resources, Environmental Protection).	0.80				7.01
	Complying with water laws and regulations (not digging unauthorized wells, not relocating wells without permission, following well license conditions).	0.71				5.47
	Reporting water violations (such as unauthorized well digging or river water extraction) to the Water Affairs Department or police/judiciary authorities.	0.96				9.55
	Informing officials (district governor, governor, parliament members, Friday prayer leader) about water scarcity conditions.	0.66				5.78
	Encouraging other farmers to conserve water resources.	0.88				7.82
	Discouraging other farmers from illegal water exploitation practices (such as unauthorized well digging).	Dropped				–
	Observing the environmental water rights of nature and other creatures.	Dropped				–
	Observing the water rights of downstream farmers.	Dropped				–
	Membership and activity in social networks (e.g., Eitaa, Soroush, Bale, WhatsApp, Telegram) on water conservation.	Dropped				–
	Creating occupational and income diversification and engaging in non-agricultural income sources.	Dropped				–

responsibility, highlighting their significant influence on moral norms related to water conservation.

5. Discussion

Based on the results, the intention to conserve water resources is influenced by moral norms, attitude toward conservation, and past experience. Moral norms significantly and positively affect farmers' behavioral intentions, meaning farmers with stronger moral norms are more inclined to adopt water conservation behaviors. This finding aligns with various studies, such as those by Goldstein et al. (2008), Wauters et al. (2017), Surjanti et al. (2023), and Savari et al. (2023a,b), which report that internal subjective standards like moral values and norms influence environmental behaviors by forming an internal commitment to actions like reducing water consumption and protecting resources. In other words, moral norms are a dominant driver of conservation intentions, often surpassing purely cognitive factors (e.g., attitudes, perceived control) in agricultural contexts (Batool et al., 2024; Maleki et al., 2025).

In addition to moral norms, attitude directly and significantly affects farmers' behavioral intentions. This finding supports TPB (Ajzen, 1991; Bozorgparvar et al., 2018; Surjanti et al., 2023; Zhang et al., 2024) according to which positive attitudes can directly reinforce behavioral intention. On the other hand, the positive and significant effect of past experience on behavioral intention was confirmed, but it was not as strong as moral norms and attitude. This result is consistent with findings by Haden et al. (2012), Mooney et al. (2019), Li et al. (2020), and Moons et al. (2022), which indicate that successful past experiences in protecting natural resources motivate similar future behaviors. Thus, training programs or previous water conservation campaigns in the Sistan Plain positively impact farmers' intentions, but their effect can be enhanced by considering emotional and moral factors. Interestingly,

Table 3
The fit indices of the models.

Test	Recommended value	Theory of planed behavior	Norm activation model	Integrated model
Likelihood ratio Chi-square (x2)	Insignificant ×2 ($p > 0.05$)	0.000	0.204	0.02
Normed chi-square (x2/df)	x2/df < 5	3	2.1	2.26
Root Mean Square Residual	RMR<0.08	0.06	0.07	0.06
Root Mean Squared Error of Approximation	RMSEA<0.08	0.504	0.04	0.06
Goodness-of-Fit Index	GFI>0.90	0.94	0.93	0.93
Incremental Fit Index	IFI=Values close to 1	0.95	0.99	0.99
Comparative Fit Index	CFI>0.90	0.93	0.99	0.99

perceived behavioral control did not significantly influence farmers' behavioral intentions. This suggests that even if farmers have the necessary capabilities or resources, they are less likely to engage in protective behaviors without positive attitudes or strong moral norms. In other words, perceived behavioral control is effective only when combined with strong attitudes and values. A possible explanation is that in the Sistan Plain, farmers face structural and institutional constraints (e.g., limited access to water-saving technologies, financial barriers, or weak extension services) that reduce the role of perceived control in shaping their intentions. This result is more consistent with studies showing that when external conditions limit actual behavioral options, the effect of PBC tends to weaken (Yazdanpanah et al., 2015).

Moral norms, as the most significant factor influencing behavioral intention, are themselves influenced by awareness of the consequences of environmental actions. However, the ascription of responsibility did not significantly affect moral norms. According to NAM, the effectiveness of moral norms in fostering protective behaviors depends on activating these personal norms through awareness of the consequences of protective and non-protective measures and acceptance of responsibility. Without this activation, personal norms remain inactive and do not lead to pro-environmental behaviors. Our findings suggest that awareness of the consequences of protective and non-protective actions directly and strongly activates moral norms, thereby enhancing intentions for water conservation. More informed farmers have a stronger moral commitment to water conservation and are more likely to engage in protective behaviors. This result aligns with studies by Vaske et al. (2020), Hallaj et al. (2021a,b), Yang et al. (2024), and Xu et al. (2024), which emphasize that awareness of the consequences of destructive behaviors is a crucial prerequisite for fostering moral commitment to environmental conservation.

Consistent with integrated TPB–NAM applications, awareness of consequences indirectly shapes intention by activating moral obligations, while past experience exerts a direct effect on intention and may reinforce favorable attitudes toward water-saving practices (Gkargkavouzi et al., 2019; Wang et al., 2019). Taken together, these results suggest that interventions combining informational campaigns (to raise consequence awareness) with norm-based strategies (to strengthen moral commitment) are likely to be more effective than approaches targeting rational appraisals alone—particularly in water-stressed farming regions.

This research demonstrates that protective attitudes are influenced by moral norms. Indeed, moral norms strongly affect farmers' attitudes toward the protection of water resources. Farmers who embrace these norms have more positive attitudes toward water conservation, consistent with studies by Feisthauer et al. (2024), Bagheri et al. (2019), Menatizadeh et al. (2016), and Kaiser (2006). These researchers highlight that moral and social values can strongly incentivize the

Table 4
The results of path analysis.

Model	Paths			Standardized regression weights	Indirect effects	t-value	Sig.	Squared multiple correlations	Hypothesis
Theory of planed behavior	Attitude	→	Behavioral intention	0.806	–	24.96	0.000	0.647	Confirmed
	Social pressure			0.002	–	0.04	0.965		Rejected
	Perceived behavioral control			0.024	–	0.59	0.553		Rejected
Norm activation model	Awareness of consequences	→	Behavioral intention	0.625	0.22	12.11	0.000	0.756	Confirmed
	Ascription of responsibility			0.04	0.013	1.52	0.12		Rejected
	Past experience			0.064	0.000	2.39	0.01		Confirmed
	Moral norms			0.261	0.000	5.1	0.000		Confirmed
Integrated model	Moral norms	→	Attitude	0.653	0.000	8.74	0.000	0.476	Confirmed
	Past experience			0.046	0.000	1.19	0.23		Rejected
	Awareness of consequences			0.033	0.56	0.44	0.65		Rejected
	Attitude	→	Behavioral intention	0.469	0.000	13.33	0.000	0.771	Confirmed
	Past experience			0.07	0.022	2.68	0.007		Confirmed
	Perceived behavioral control			0.008	0.021	0.325	0.745		Rejected
	Moral norms			0.473	0.306	13.45	0.000		Confirmed
	Awareness of consequences	→	Ascription of responsibility	0.11	0.000	2.69	0.007	0.42	Confirmed
	Perceived behavioral control			0.56	0.000	10.95	0.000		Confirmed
	Social pressure			0.122	0.000	2.37	0.018		Confirmed
	Awareness of consequences	→	Moral norms	0.862	0.005	31.47	0.000	0.737	Confirmed
	Ascription of responsibility			0.049	0.000	1.79	0.07		Rejected

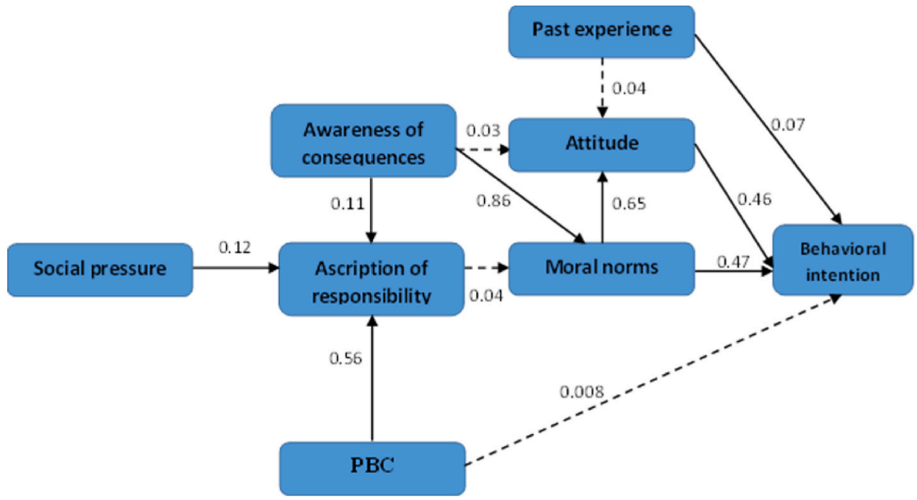

Fig. 2. The final model of the research.

development of environmental intentions and attitudes. This implies that training programs in agricultural communities will be effective if they focus on promoting moral norms and emphasize social responsibilities. However, the results also showed that past experience and awareness of consequences did not significantly affect attitudes. This contradicts previous studies, such as Moons et al. (2022), which found that positive past experiences can strengthen attitudes. This discrepancy may be due to the cultural and structural characteristics of the target community in the Sistan Plain, where past experience alone may not be sufficient to alter beliefs. This underscores the need to consider region-specific social and economic conditions.

The ascription of responsibility was influenced by perceived behavioral control, social norms, and awareness of consequences. The positive effect of perceived behavioral control on the ascription of responsibility indicates that farmers who believe they can implement protective measures feel more responsible for doing so. This finding is consistent with studies by Nguyen et al. (2021), Doran et al. (2020), and Rezaei et al. (2019a,b,c), which show that perceived ability and control over resources enhance motivation to accept responsibility and change behaviors. In agricultural regions like the Sistan Plain, this can be reinforced by increasing access to resources and adopting more efficient technologies. The significant effect of awareness of consequences on the ascription of responsibility suggests that farmers informed about the environmental impact of their behaviors are more likely to feel responsible for protecting water resources. This finding supports the results of Xie et al. (2021) and Vaske et al. (2020), which state that awareness of the negative effects of behaviors on the environment fosters a sense of responsibility and leads to more responsible behaviors. Educating farmers about the implications of improper water use and its effects on the ecosystem can thus be an effective way to increase their responsibility for water conservation. Additionally, the positive effect of social pressure on the ascription of responsibility suggests that farmers influenced by social expectations regarding water conservation feel more responsible for these actions. This is in line with studies by Delpont et al. (2021), Wang et al. (2023), and Kaine and Wright (2024), which found that social groups and local networks play a key role in shaping environmental behaviors. Ultimately, the combination of awareness of consequences, social pressure, and the ascription of responsibility can significantly reinforce moral norms and protective attitudes, underscoring the importance of multidimensional approaches to policy-making and planning.

Past experience did not significantly influence farmers' attitudes toward water conservation. While prior research (e.g., Gkargkavouzi et al., 2019) has suggested that behavioral experience can shape positive environmental attitudes, our findings indicate that farmers in the study area may not have had consistent or successful experiences with water-saving practices in the past. In fact, when past experiences are fragmented, ineffective, or constrained by lack of institutional support, they may not lead to more favorable attitudes.

Finally, awareness of consequences did not have a significant effect on attitudes. This finding is partly at odds with the arguments of Steg and De Groot (2010), who suggested that greater awareness of environmental consequences tends to foster pro-environmental attitudes. One explanation could be that while farmers are aware of the environmental problems, their attitudes are shaped more strongly by economic considerations and immediate livelihood concerns than by abstract or long-term consequences. This result is in line with Savari et al. (2025), who found that awareness alone may not translate into attitudinal change unless it is accompanied by strong moral or institutional drivers.

The comparison of models further confirmed the added value of integrating NAM into the TPB framework. Specifically, when the constructs of awareness of consequences, ascription of responsibility, and moral norms were included, the integrated model achieved stronger explanatory power and better fit indices compared to the TPB-alone model. This improvement suggests that farmers' water conservation decisions are shaped not only by rational–cognitive evaluations but also by moral obligations and internalized norms. Similar conclusions have been reported by Danesh-pajooh et al. (2025); Duong et al. (2024); Zhu et al. (2024a,b); Fan and Ye (2025) and Muthukumari et al. (2024), who found that extending TPB with moral–normative constructs significantly enhanced the prediction of pro-environmental behaviors. Thus, our findings reinforce the argument that integrating rational and moral dimensions provides a more comprehensive and robust framework for analyzing conservation behaviors, particularly in resource-scarce agricultural contexts.

6. Conclusions

The present research aimed to explain the intention to adopt water conservation behaviors by combining rational and moral behavioral models. The integrated TPB-NAM model encompassed a range of moral-normative variables (moral norms, ascription of responsibility, and social norms) and rational variables (awareness of consequences, protective attitude, perceived behavioral control, and past experience) that were expected to influence farmers' intentions to conserve water resources. The direct influence of moral norms on behavioral intention, as emphasized by NAM, highlights the significance of moral and normative factors in explaining water conservation intentions and behaviors. Additionally, the key role of variables such as awareness of consequences, protective attitude, and past experience in forming protection intentions underscores the importance of the variables emphasized in rational models like TPB in the context of water resource protection. Therefore, integrating rational and moral behavioral models for analyzing environmental and protective intentions can provide a more comprehensive understanding of water conservation decisions.

The exploration of moral, social, and cognitive factors influencing farmers' intentions to conserve water resources revealed that moral norms and positive attitudes are the main incentives for the intention to exhibit protective behaviors. Furthermore, past experience and social pressure play a significant role in reinforcing these behaviors, although they are less influential than moral norms. The effect of awareness of consequences on ascription of responsibility and the effect of perceived behavioral control on this variable showed that farmers who are more informed about the environmental consequences of their behaviors and have greater control over resources and facilities are more inclined to accept responsibility for the protection of water resources.

6.1. Theoretical implications

The results provide several important theoretical implications for better understanding farmers' behaviors to conserve water resources.

The first theoretical implication is that the replacement of one-dimensional approaches (merely rational or merely moral) with integrated (rational-moral) approaches can serve as a foundation for environmental research, offering a more thorough insight into the factors influencing protective intentions and behaviors. This research recommends considering moral variables (e.g., moral norms and ascription of responsibility) and rational variables (e.g., awareness of consequences, protective attitude, and perceived behavioral control) simultaneously.

Another implication is the key role of moral norms in completing protective behavior theories. The research confirms that moral norms can complement rational theories like TPB by directly influencing attitude and behavioral intention. Additionally, as emphasized in NAM, attention must be paid to the activation of personal and moral norms through awareness of behavior consequences and ascription of responsibility.

As another theoretical implication, past experiences can be considered a complementary component. This supports social learning theory, which emphasizes the importance of direct experience or observation of similar behaviors. Despite the significance of past experiences with protective behaviors and people's positive or negative experiences, which can influence their subsequent intentions and behaviors, prominent protective behavior models, such as TPB and NAM, have overlooked this important factor in explaining environmental behavior.

The integration of TPB and NAM offers several distinct advantages over using either theory alone. First, it captures the rational–cognitive determinants of behavior—attitudes, perceived behavioral control, and subjective norms—while also incorporating moral–normative factors such as awareness of consequences, ascription of responsibility, and moral norms. Second, this dual approach improves the explanatory power of the model, as it accounts not only for deliberate cost–benefit evaluations but also for internalized moral obligations. Third, the findings reveal that personal norms, derived from NAM, provide a more stable and enduring predictor of conservation behavior compared to social norms, which are more context-dependent. These insights demonstrate that pro-environmental behavior cannot be fully understood without considering both rational choice mechanisms and moral responsibility, thus extending the theoretical discourse in environmental psychology and behavioral science.

6.2. Practical implications

The findings also carry clear implications for policymakers and practitioners. First, educational and awareness-raising campaigns should focus on enhancing farmers' understanding of the long-term and indirect consequences of water mismanagement, as awareness of consequences is a key driver of moral obligation. Second, programs that emphasize moral responsibility—for example, community-based water conservation initiatives that foster a sense of collective duty—can strengthen farmers' personal norms and commitment to sustainable practices. Third, capacity-building initiatives such as training workshops and technical support should be implemented to improve farmers' perceived behavioral control, enabling them to adopt water-saving technologies more effectively. Finally, policy frameworks should integrate social and moral dimensions by combining external incentives (e.g., subsidies, regulations) with strategies that reinforce internalized moral norms, thereby creating a multi-level support system for sustainable water use.

6.3. Limitations and suggestions

Like any empirical research, this study has several limitations that should be acknowledged. First, the data were collected using a cross-sectional survey, which restricts the ability to capture dynamic changes in farmers' attitudes and intentions over time. Future research could employ longitudinal designs to examine how pro-environmental behaviors evolve and how stable the integrated rational–moral model remains across different time frames.

Second, the study relied on self-reported data, which may be subject to social desirability bias and recall errors. Although steps were taken to minimize such biases, including anonymity assurances, future studies could combine survey responses with behavioral observations or experimental approaches to validate findings.

Finally, the integrated rational–moral model included key constructs from the TPB and NAM; however, other potentially relevant psychological factors—such as environmental identity, emotions, and habit—were not examined. Incorporating such variables in future research may further enhance explanatory power and provide a more comprehensive understanding of water conservation behaviors.

CRediT authorship contribution statement

Meysam Menatizadeh: Writing – original draft, Methodology, Conceptualization. **Pouria Ataei:** Writing – original draft, Methodology, Formal analysis, Conceptualization. **Hamid Karimi:** Writing – review & editing, Supervision, Data curation. **Afshin Mottaghi Dastenaei:** Writing – review & editing, Validation, Investigation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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