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Analysis of factors influencing farmers' sustainable environmental behavior in agriculture activities: integration of the planned behavior and the protection motivation theories

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Abstract
Unsustainable agricultural activities have made governments in developing countries confront numerous environmental challenges and crises in rural areas. The environmental problems of the agricultural sector, in addition to being affected by factors such as the economy and the specific characteristics of agricultural products, are also influenced by the individual and professional farmers' behavior. The importance of farmer's behavior in environmental concerns may be traced back to the effect and control which behavior has over other variables. However, the lack of appropriate environmental cognitive behavioral and socio-psychological models and poor understanding of factors influencing the environmental behavior of farmers, inhibit farmers from adopting pro-environmental behaviors in agricultural activities. As a result, the current study aimed to fill this gap by combining the theory of planned behavior (TPB) and the protection motivation theory (PMT) to identify the key predicting factors of farmers' sustainable environmental behavior (SEB) and their behavioral intentions in various agricultural activities (such as agronomy, horticulture, livestock and natural resources).This research was a descriptive, causal and correlational study conducted through a cross-sectional survey of 300 farmers in Zanjan Province of Iran for which the structural equation modeling (SEM) technic has been utilized for analysis. The results indicated that the PMT variables, including self-efficacy, perceived vulnerability, and severity, response costs, and efficacy could significantly explain variability of farmers' intention toward sustainable environmental behavior. Through adding the variables of TPB consisting attitude toward behavior, subject norm and perceived behavioral control increased the prediction variance of intention and behavior of farmers. Thus, the integrated model provides a better understanding of SEB, especially via the behavioral intention of farmers. The development of SEB in agricultural activities among farmers and their intention toward sustainable environmental behavior requires a comprehensive, systematic, and multidimensional approach such as the integrated model outlined in this study.

Keywords Farmers' sustainable environmental behavior · Agriculture activities · Theory of planned behavior · Protection motivation theory

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1 Introduction

The worldwide agriculture sector, particularly in developing countries, faces several challenges with devastating effects (Antle & Ray, 2020; Liu et al., 2020; Pandey, 2020; Serraj & Pingali, 2019). The researchers have mentioned various challenges in this sector such as the nature of agricultural products, much of which is wasted due to the rapid contamination(González-Estrada et al., 2018; Mahmood et al., 2019; Singh & Singh, 2019); climate change such as drought (Buurman et al., 2020; Eze et al., 2020; Foltz, 2002; Kuwayama et al., 2019; Rita et al., 2020), quantitative and qualitative problems of water such as water shortage and/or pollution (El-Zeiny & El-Kafrawy, 2017; Elshemy et al., 2020; Goharian & Azizipour, 2020; Shen et al., 2014; Yang et al., 2018), hail and frostbite that have also caused many problems for agriculture (Choudhury et al., 2019; Dalhaus et al., 2019; Deihimfard et al., 2019; Mendez & Dasig, 2020). Other issues in the agriculture sector are connected to farmers' personal characteristics (Devitt, 2018; Fashogbon & Mushunje, 2018), such as their growing average age (Boon et al., 2010; Brown et al., 2019; Gates, 2017; Mazouch & Krejčí, 2016; Van Rensburg et al., 2009) and poor educational level (Bendapudi et al., 2019; Best, 2009; Saduak et al., 2017). In many situations, industrial agriculture has diminished biodiversity, resulting in pollution and human health problems (Brooks et al., 2013; Harney, 2019). Furthermore, economic factors such as subsistence agriculture (Cobbinah et al., 2015) and low income of the villagers and their efforts for the minimum livelihood can be considered as other reasons for environmental degradation. In the meantime, some researchers have identified many of the challenges of the agriculture sector as related to the behavior of farmers (Akintunde, 2017; Braakhuis, 2016; De Vries, 2012; James, 2003) which have devastating effects on the environment (Braakhuis, 2016; VanDeveer, 2015). The importance of farmers' behavior in the environmental destruction has invited many researchers to focus on the role of farmers and their individual characteristics in the environmental behavior (Burton, 2014; Floress et al., 2018; Lund et al., 2004; Rhead et al., 2015). The inappropriate actions of farmers in agronomical, horticultural, animal and other agricultural-related activities, such as unauthorized use of fertilizers and pesticides, abandonment of chemical pesticides containers in the environment (Joko et al., 2017), unauthorized harvesting of rangelands and destruction of natural resources (Bijani et al., 2019; Pender et al., 2020; Saguye, 2017), unnecessary water use and loss of water resources (Dolnicar et al., 2012), traditional irrigation, high water loss, drilling deep and semi-deep wells (Keshavarz & Karami, 2014, 2016), setting the agricultural crop and orchard residues on fire after harvesting (Bray et al., 2019; Gogoi et al., 2020; Seglah et al., 2020), absence of modern irrigation systems to save water, inappropriate tillage and plowing practices (Chan & Hulugalle, 1999), and releasing animal waste into the environment are few among all inappropriate behavior of farmers that endangers the sustainability of the environment (Bronfman et al., 2015; Gifford & Nilsson, 2014; Larson et al., 2013; Price & Leviston, 2014).

Behavior is a key concept in the socio-psychological sciences (Gifford & Nilsson, 2014; Uher, 2016) and in environmental studies to achieve sustainable development of the environment (Khajeshahkoohi et al., 2015). The scientists have studied the effects of variables on environmental activities in the form of various models and theories, the most famous of which include Fishbein and Ajzen's Theory of Reasoned Action (1975), Ajzen's theory of planned behavior (TPB) (1991), Stern et al.'s (1995) value-belief-norm theory and Rogers's (1983) Protection Motivation Theory (Wang et al., 2019). Among various theories Ajzen's TPB has been popular in the explanation of environmental behavior (Gao et al., 2017; Greaves et al., 2013). This theory has been extensively used in environmental protection behavior and as a framework for many studies such as Clement et al., (2014), energy conservation behavior research, Synodinos and Bevan-Dye (2014) green purchasing behavior research, Chan & Bishop (2013) recycling behavior and so on (Macovei, 2015). In recent years, PMT has been used to anticipate environmental behavior and climate change (Church et al., 2017; Keshavarz & Karami, 2016; Wang et al., 2019). PMT is a comprehensive theory that focuses not only on the individual costs of consistent behavior (such as the theory of planned behavior) but also on collective action (for example, response cost and self-efficacy), as mentioned in earlier research (Keshavarz & Karami, 2016; Wang et al., 2019).

This study was conducted in Zanjan County since its rural areas are considered as an agricultural hub in Iran. The livelihood of the vast majority of rural households in Zanjan is based on agricultural activities. However, this powerful agricultural hub is facing environmental problems and instabilities, including water and soil pollution as a result of excessive use of fertilizers and pesticides, deep plowing and non-observance of crop rotation, imbalance of livestock numbers and rangeland carrying capacity, the existence of open and stinking sewage atmosphere and the entry of house effluents into which may be used in irrigation of gardens and fields, destruction of gardens and agricultural lands and severe pollution of Zanjan Chai river due to industrial wastewater overflow (Naddafi et al., 2007). Thus, the main problem of this study is environmental pollution in this region which, on the one hand, is a concern for the health and sustainability of production; on the other hand, it is a matter of concern for the issue of sustainable livelihood of the rural community, whose agriculture is their only source of income. This implies that the area is vulnerable to environmental issues, necessitating a study of farmers' attitudes and behavior toward environmental protection (Bijani et al., 2017). Previous research has emphasized the impact of environmental conservation and statistics on environmental deterioration rather than behavioral and managerial issues. In this study, in addition to investigating and identifying the factors affecting the sustainable environmental behavior of farmers, we sought a new model of factors affecting farmers' sustainable behavior by the integration of theory of planned behavior (which emphasizes individual behaviors) and Protection Motivation Theory (which emphasizes collective action in addition to individual factors). Therefore, the main research questions are to examine and understand how individual and behavioral motivational factors influence the intention of farmers and their SEB? Furthermore, does the combination of PMT and TPB theories have greater power in predicting farmers' behavioral intentions and their environmental behavior?

2 Theoretical background

2.1 The theory of planned behavior (TPB)

The theory of planned behavior (TPB) is developed from Fishbein & Ajzen (1975) theory of reasoned action (Wang et al., 2019). This theory states that intention is, in practice, the most important predictor of behavior, in turn, driven by attitudes toward behavior, subjective norms and perceived behavioral control (Braakhuis, 2016). The behavioral intentions in environmental protection include a set of expectations, demands and truths for making rational choices for solving environmental problems (Macovei, 2015). The subjective norms are normative beliefs that include a reference group such as the family as the focus of beliefs influencing individuals' intentions to behave (Satsios & Hadjidakis, 2018). In rural society, which is a small community and subject to norms, social pressure has a lot of power to guide intention and behavior, but are these pressures also available and effective for the implementation of environmentally friendly behaviors? According to Ajzen (1991) perceived behavioral control explains how one perceives his own ability to perform a behavior, which depends not only on his social attitudes and limitations, but also on personal beliefs about participation in environmental problem solving (Ajzen, 1991; Yuriev et al., 2020). Perceived behavioral control affects both behavioral intentions and behavior (Niaura, 2013) and has a positive and significant relationship with environmental behavior (Maleksaeidi & Keshavarz, 2019; Wang et al., 2019). Since the rural families in the study area's economy are mostly subsistence and reliant on agricultural operations on restricted lands, economic issues often limit their capacity to engage in pro-environmental practices. As a result, farmers' perceptions of control over environmental behavior must be taken into account in both intention and behavior.

Attitude indicates the extent to which one evaluates good or bad behavior (Ajzen, 1991) has also stated that if one's attitude toward a behavioral outcome is positive, there are more motivational factors and consequently a stronger intention to enforce the behavior and the emergence of actual behavior (Wang et al., 2019). Lack of implementation of environmentally friendly behaviors in the studied villagers, as stated in introduction, is one of the concerns of this study, which may be rooted in the attitude of farmers, and therefore, the study of attitude is considered as an independent variable. Thus, based on the theory of planned behavior and presented justifications, we formulated the following hypotheses:

H1 Attitude toward the behavior has a significant positive effect on farmers' behavioral intention.
H2 Subjective norms have a significant positive effect on farmers' behavioral intention.
H3 Perceived behavioral control has a significant positive effect on farmers' behavioral intention.
H4 Perceived behavioral control has a significant positive effect on farmers' agricultural sustainable environmental behavior.
H5 Farmers' behavioral intention has a significant positive effect on farmers' agricultural sustainable environmental behavior.

2.2 The protection motivation theory (PMT)

PMT was first introduced by Rogers (1983) to identify the effects of fear and how to deal with it (Almarshad, 2017). It is a useful socio-cognition model (Pourhaji et al., 2016) that applied in recent years to predict individuals' intention and willingness to participate in protective behaviors (Karami & Ahmadi, 2022; Shafiei & Maleksaeidi, 2020b; Xiao et al., 2016). Individuals participate in actions that deal with environmental dangers through knowing susceptibility and risk severity, and assessing these risks via reaction, according to this theory (Bockarova & Steg, 2014). This model describes which predictors are important in efficiently interacting with the environment (advantages, disadvantages and dangers), as well as how well one perceives and motivates an action (to adapt to it or decrease risk) (Perloff & Ray, 1991; Stewart, 2015). In fact, the protection motivation model explains the human behavior depends on two correlated paths of threat appraisal and coping appraisal (Chen, 2020). Threat appraisal is actually the appraisal of how much individuals perceive a particular behavioral threat (Xiao et al., 2016). The main process of threat appraisal is the perceived severity and vulnerability of environmental problems. The perceived vulnerability is the personal judgment of the likelihood of the threat of environmental destruction (Almarshad, 2017; MacDonell et al., 2013; Scarpa & Thiene, 2011; Zhao et al., 2016). Farmers' perception of the threat is one of the behavioral intention variables resulting from improper agricultural activities such as excessive use of water resources, increased use of chemical fertilizer, waste separation, burning of bushes and natural shrubs and so on, and it is linked to farmers' realization that if they do nothing to prevent the threat, something bad will happen to the environment. The perceived severity is also an unintended consequence that refers to individual emotions associated with negative events (Badsar & Karami, 2021; Tsai et al., 2016). In this case, the severity related to farmers' appraisal of the intensity effect of their action on the environmental degradation. The coping appraisal is the appraisal of one's ability to deal with threats (Xiao et al., 2016). In other words, the coping appraisal focuses on one's available responses to the threat (Chen, 2020) and examines factors that increase or reduce the likelihood of consistent and adaptive responses, such as behavioral recommendations (Norman et al., 2005). The coping appraisal includes self-efficacy, where the perception of one's own ability to successfully perform a given task can be a factor in an attempt to perform it (Bandura et al., 1999; Allen & Ferrand, 1999) stated that self-efficacy is an important part of developing environmental behaviors (Levy et al., 2016). In fact, it refers to an individual's belief regarding the capability to act and maintain new behaviors (Church et al., 2017; Straub & Leahy, 2014). Another component is response efficacy, which refers to beliefs that a successful behavior will minimize or eliminate threats (Almarshad, 2017; Bandura et al., 1999). In the context of this study, response efficacy refers to the efficacy of pro-environmental actions to reduce the hazardous consequences of agricultural activities. Another component is the response cost, which refers to the sum of the barriers to participate in the desired behavior, including economic and non-economic values such as time, effort, inconvenience and discomfort (Almarshad, 2017; Scarpa & Thiene, 2011). In fact, the response cost is the accountability cost and includes all costs (for example, money, person, time and effort) related to receiving a mutual and consistent response (MacDonell et al., 2013; Pourhaji et al., 2016; Zhao et al., 2016) found that response cost negatively influences the environmental behaviors of farmers because they typically lack the necessary resource. Since in the subsistence agricultural business condition, as in the study area, there is always a conflict of interest between observance of environmental principles and farmers 'livelihoods, finding operational solutions tailored to farmers' perspectives are an important part in predicting environmental behavior. This study was investigated using coping behaviors.

We tested the following hypotheses based on PMT:

H6 Self-efficacy has a significant positive effect on farmers' behavioral intention.

H7 Perceived vulnerability has a significant positive effect on farmers' behavioral intention.

H8 Perceived severity has a significant positive effect on farmers' behavioral intention.

H9 Response efficacy has a significant positive effect on farmers' behavioral intention.

H10 Response cost has a significant negative effect on farmers' behavioral intention.

2.3 The integrated model and hypotheses

Using the integration of PBT and PMT, the present study addresses the factors affecting the farmers' behavioral intention (Fig. 1). Ajzen's TPB (1991) includes subjective norm, attitude and perceived behavioral control covers individual costs of consistent behavior,

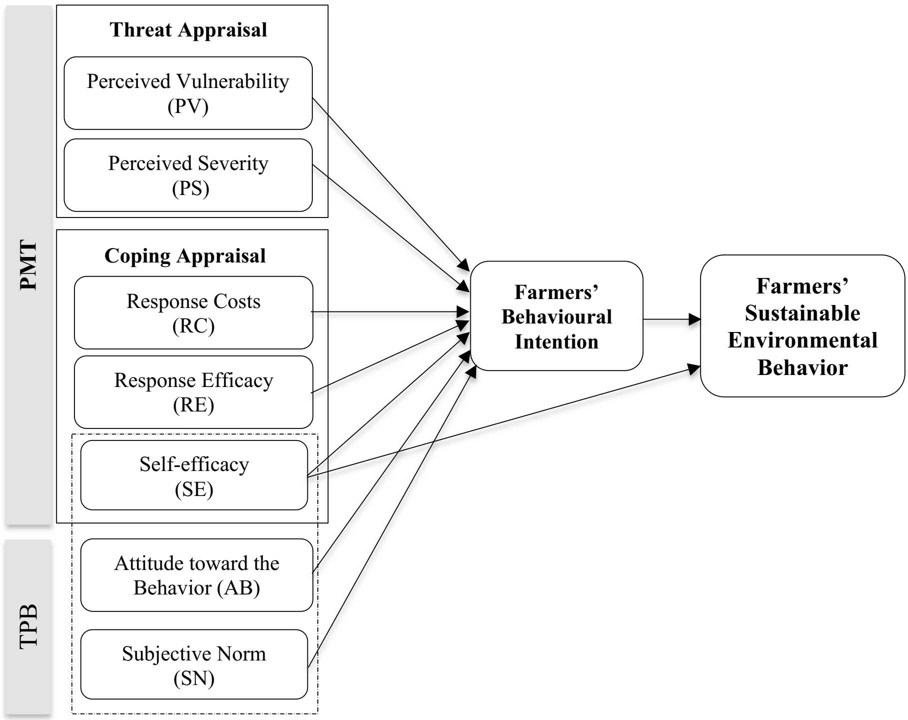

Fig. 1 Theoretical research framework (adopted from Wang et al., (2019, p. 17)

while PMT (1983), which includes vulnerability, severity, response efficacy, self-efficacy and response cost, in addition to individual perspectives on cost relies on collective action. The idea of this combination is supported by the study of Wang et al. (2019) that found this theoretical integration has a higher predictive power than using two TPB and PMT theories alone. Jokonya (2017) shows that although the TPB is appropriate for explaining and predicting behavior and intention to act, drawbacks and criticisms are also. In this regard, Lam (2006) stated that in order to predict a behavior, behavioral motivations and costs are vital but absent in the planned behavior model. According to Ajzen's TPB (1991), perceived behavioral control is highly consistent with the concept of self-efficacy (Wang et al., 2019), which in PMT were investigated in terms of self and response efficacy. Previous studies (De Leeuw et al., 2015; Wang et al., 2019) have also shown that self-efficacy positively and directly affected actual behavior. This study's contribution in integrating two socio-psychological theories in the agricultural context helps to fill the gap as how individual and behavioral motivational factors influence farmers' intention on their SEB. The importance of explaining the intention of farmers on SEB using theories which are popular in environmental protection is related to a close relation between agricultural development and environmental sustainability, more specifically in developing countries. The results of empirical studies such as the present study, as stated by Babu et al., (2018), will help legitimize efforts to integrate environmental concerns into agricultural and rural activities. Therefore, the following hypotheses were tested based on Integrated Model:

H11 Integrated model of the two theories of TPB and PMT had higher predictability than the separate models.

H12 Self-efficacy has a significant positive effect on farmers' SEB.

H13 Farmers' behavioral intention has a mediating role in the relationship between independent variables derived from TPB (including AB and SN), PMT (including PV, PS, RE, SE and RC) and the SEB.

3 Materials and methods

3.1 Sampling and data collection

The study location was Zanjan County located in northwestern of Iran with an area of 156 km^2. According to Iran's Statistical Centre, in 2017, 521,302 people lived in Zanjan from whom 87,826 lived in rural areas (Iran's Statistical Centre, 2017). The target population of this study comprised the farmers in Zanjan County (N = 18,467) (Zanjan Agri-Jihad Organization, 2017). The county of Zanjan is located in Zanjan Province and is made up of three districts called Zanjanrud, Central and Ghara poshtlou. The applied sampling procedure to make a representative sample was multistage stratified sampling. In the first step, rural districts were randomly selected from each district of Zanjan county. Thus, for each of Central and Zanjanrod districts two rural districts, and Ghara poshtlou district due to the lower percentage of farmers, one rural district was randomly selected and altogether comprises five rural districts. In the last step, villages and related respondents of each rural district were determined randomly in total 300 respondents from 27 villages. The sample size was calculated 263 using the Cochran formula, but to ensure the sample's adequacy, the number of samples was increased to 300. This descriptive, causal and correlational study was conducted through a survey in terms of data analysis. The primary data were collected through the structured interview technique. On average, each interview took about 2 h, and the duration of the data collection was approximately 45 days with accompanied of three trained interviewers.

3.2 Questionnaire design

To test the hypotheses described above in Fig. 1, the questionnaire survey method was used to collect data. The study questionnaire was segmented to four parts. The first section of the questionnaire consisted of the demographic attributes of the respondents (such as age, education level, farming experience, etc.). The second part of the questionnaire measures the farmers' SEB in agriculture activities. Farmers' SEB in agriculture refers to behaviors with the lowest negative impact on the rural environment. In this study, we investigated the SEB by 23 items in terms of farmers' actions in four subsection including agronomy, horticulture, livestock and natural resources derived from (Bijani et al., 2017; Buijs & Elands, 2013; Fang et al., 2018; Nunez & Clores, 2017) (Table 1). It is noteworthy that in this study, the averaging score of several items for each category of agronomic, horticultural, livestock and natural resources was considered as the main indicators for measuring SEB in agricultural activities. The reason for combining measured items was to manage the model (Hair et al., 2006) and improve the fit as it reduces the complexity of the model with easier interpretation of the model, as suggested by Landis et al., (2000). The third section of the questionnaire consisted of 26 items to measure the TPB variables (behavioral intention (5 items), attitude toward behavior (11 items), subject norm (5 items) and

Table 1 Constructs and measurement items included in the questionnaire

Constructs (number of items)	Measurement items (symbols)	Sources
Theory of planned behavior (TPB)		
Subjective norm(5 items)	I feel social pressure for saving energy It is expected of me as one of the community members to do environmentally friendly behavior in agricultural activities Most people who are important to me recommend me to use biofertilizer instead of chemical fertilizer Most people who are important to me support my efforts to protect the environment in agricultural activities If I consume less water in agricultural activities, others will admire my behavior	(Clement et al., 2014; Fang et al., 2018; Macovei, 2015; Paul et al., 2016; Shi et al., 2017)
Perceived behavior control (5 items)	I am confident that I could have good behaviors to environmental protection in agricultural activities It is easy for me to control my own and others' environmental behaviors in agricultural activities I need more training to reduce energy consumption to protect the environment in agricultural activities The decision to save water is better for my future agricultural activities I believe that I am responsible for protecting the environment we are living in.	(Ajzen, 1991, 2002; Fang et al., 2018; Kumar, 2019; Shi et al., 2017)

Table 1 (continued)

Constructs (number of items)	Measurement items (symbols)	Sources
Attitude toward the Behavior (AB) (11 items)	Nature must be protected because it is a sign of the existence of God I am concerned about the issue of nature and forests For me conserving water is important in agricultural activities In my opinion, more control should be placed on agricultural activities to maintain the quality of the environment I think there are enough laws to protect the environment in agriculture sector I disagree with environmental regulations that restrict my way of life. I think environmental protection is the duty of the government, not farmers (dropped) For me the issue of sewage and poor sanitation in the community is important In my opinion, all creatures such as animals and plants have the right to live. For me environment also belongs to the next generation, so it must be protected Man is a part of the environment, so its protection leads to his survival	(Bijani et al., 2017; De Leeuw et al., 2015; Li et al., 2018; Li & Yang, 2010; Macovei, 2015; Nunez & Clores, 2017)

Table 1 (continued)

Constructs (number of items)	Measurement items (symbols)	Sources
Intent (5 items)	I intend to commit to protecting the environment in agricultural activities. I intend to produce healthy agricultural products with less use of chemical materials I intend to put extra effort into using natural resources in a responsible way. I intend to use new irrigation methods in agricultural production to protect the environment and conserve water resources for future generations I intend to change my working style in agricultural activities (such as the proper use of productive resources such as soil, water, etc.) to become an environmentalist	(Ajzen, 1991; De Leeuw et al., 2015; Kumar, 2019; Nunez & Clores, 2017; Qi-yan & Yan-li, 2011; Verma & Chandra, 2017)
Perceived vulnerability (7 items)	Dropping plastic can and glass containers cause a damage to the environment The damage to the environment is not important to me Excessive use of water resources and reserves in agriculture can damage the environment More use of chemical fertilizer can destroy the environment. Waste separation is useful in reducing environmental damage. Burning bushes and natural shrubs as fuel can damage the environment Failure to comply with environmental principles in the agricultural sector will cause many environmental problems	(Bubeck et al., 2013; Church et al., 2017; Keshavarz & Karami, 2016)

Table 1 (continued)

Constructs (number of items)	Measurement items (symbols)	Sources
Perceived severity (6 items)	I feel that over-grazing is a serious reason for the destruction of the environment. I feel that non-conservation agriculture (overuse of pesticide, poisons etc.) is a serious reason for the destruction of the environment. I believe that environmental degradation in agriculture sector is very serious I believe that if we do not protect the environment, we will be exposed to the long-term consequences such as drought, poverty and hunger I believe that cutting down trees can severely destroy the environment That the world is facing an environmental crisis is very exaggerated in my eyes	(Church et al., 2017; Janmaimool, 2017)
Response efficacy (5 items)	By using biofertilizer and organic fertilizer, I will able to protect the environment. By using the recycle materials, I will able to protect the environment. Using the new and modern technologies can be effective in protecting the environment. The quality of the environment can be improved by planting trees Livestock and pasture management is very effective in protecting the environment	(Janmaimool, 2017; Keshavarz & Karami, 2016; Le Dang et al., 2014; Shafiei & Maleksaeidi, 2020a)

Table 1 (continued)

Constructs (number of items)	Measurement items (symbols)	Sources
Self-efficacy (6 items)	I can provide technical advice to other farmers on the principles of environmental protection I have the knowledge, experience and skills required to protect the environment in agricultural activities I am confident that by using the conservation agriculture, I can be effective in protecting the environment. If I want I can protect the environment easily, and I can take responsibility for it on my farm I can help to protect the environment, by changing from farm activities to non-farm activities I am confident that by changing water use practices to modern methods (like drop irrigation), I can management the energy consumption	(Bubeck et al., 2013; Doran et al., 2015; Le Dang et al., 2014; Stewart, 2015)
Response cost (5 items)	I am willing to reduce my current interests to meet the needs of the next generation I am willing to pay for environmental protection I am willing to spend more time for environmental protection I am willing to make more efforts to protect the environment I am willing to abandon inappropriate agricultural practices to protect the environment, even though I have less income	(Bubeck et al., 2013; Church et al., 2017; Keshavarz & Karami, 2016)

Table 1 (continued)

Constructs (number of items)		Measurement items (symbols)	Sources
Sustainable Environment Behavior (SEB) 23 items	Agronomic activities	According to different crops cultivation requirements, I try to plow arable land with proper depth and at the right time.	(Bijani et al., 2017; Buijs & Elands, 2013; Fang et al., 2018; Nunez & Clores, 2017)
		I prefer organic and green fertilizers to chemical fertilizers in agronomic activities	
		In order to fight diseases and pests, I use pesticides correctly as instructed	
		I use conservative plow if the arable land is steep	
		After harvesting, I do not burn the remaining crop stalks (straws) left on the land	
		I use soil testing to determine fertilizer needs for soil before planting crops	
		I avoid disposing household wastes on or around the farm.	
	Horticultural activities	I do not use sewage effluent to irrigate my vegetable and garden field	
		In order to prevent fruit and vegetable pests, I prefer to use non-chemical methods	
		I use leaves from my garden trees instead of fertilizers	
		I use drip irrigation for the gardens	
		I prefer to use native varieties to grow fruit trees	

Table 1 (continued)

Constructs (number of items)		Measurement items (symbols)	Sources
	Livestock activities	I respect animals welfare as much as humans to exist	
		I am preventing the livestock from entering the pastures irregularly during the enclosure	
		I use food leftovers to feed the animals	
		I refuse to give up animal waste on the village street	
		I use animal waste properly in the fields as fertilizer	
	Natural resources activities	Instead of dumping cans, containers and bags of pesticides in nature, I usually give them to recycling operators.	
		I try to protect nature, and restrictions should be applied for accessing some areas.	
		I never cut the healthy trees just to enlarge a certain ecosystem.	
		I do not harm wild animals even if they harm crops	
		I adhere to the principles of proper harvesting of plant and medicinal species in the natural realm	
		I refuse to plow natural areas near my farmland	

perceived behavioral control (5 items) (see Table 1)). The four sections of the questionnaire comprised of 29 items to measure the PMT variables (self-efficacy (6 items), perceived vulnerability (7 items), perceived severity (6 items), response efficacy (5 items) and response costs (5 items) (see Table 1)). To measure all the variables, the farmers were asked to answer the items on a 5-point Likert scale (ranging from 1 = completely disagree to 5 = completely agree). We first identified all the variables items based on the relevant literature (see Table 1) and then the face and content validity of the questionnaire was confirmed by interviewing with subject experts including faculty members. Moreover, a pilot study, involving 30 farmers, was carried out, who were excluded from the final proposed sample area. Finally corresponding modifications were made based on the subject experts' opinions and pilot study.

3.3 Data analysis

The data were analyzed based on structural equation modeling (SEM) approach. Two-stage procedures were used to perform the SEM analysis as suggested by Hair et al., (2010) through $AMOS_{24}$ statistical software package. The reflective measurement scales were used in this study, where the indicators of constructs are assumed to be caused by the latent variables. To assess the overall model fit, various goodness-of-fit indicators (fit indices) were used, including Chi-square test statistic, relative Chi-square (χ^2/df) ratio with value not exceeding 3.0 indicated an acceptable fit (Ho, 2006), the Goodness of Fit Index (GFI) as measure of fit between the hypothesized model and the observed covariance matrix with value greater than 0.90 indicated an acceptable fit (Hair et al., 2010; Kline, 2015). Among the incremental fit indices the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI) and Incremental Fit Index (IFI) at values equal or greater than 0.90 (Ho, 2006; Scumacker & Lomax, 2010). The Root Mean Square Error of Approximation (RMSEA) with value less than 0.08 is reported as a better fit (Hair et al., 2006; Kline, 2015). The convergent validity was assessed based on three criteria as has been suggested by Hair et al., (2010, p. 709): (1) the adequacy of factor loadings (more than 0.5), (2) the average variance extracted (AVE) more than 0.50 and (3) composite reliability (CR) more than 0.70 for the measure variables. To establish discriminant validity according to Hair et al., (2010) AVE for each construct should be greater than the average shared squared variance (ASV) and the maximum shared squared variance (MSV). In the second stage, structural model is used to test the causal relationships among the latent variables and the squared multiple correlation coefficients (R^2). Finally, a "Bootstrap" method was used to analyze the indirect/mediation effect of farmers' behavioral intention in the integrated model on the relationship between SEB as dependent variable and TPB and PMT as independent variables. Bootstrap offers an estimate for the extent of the indirect effect, its statistical significance, and determines confidence intervals for the point estimate (Mallinckrodt et al., 2006).

4 Results

4.1 Descriptive sample information

The demographic attributes of the respondents showed that the respondents' mean age was 49.67 years (Table 2). In terms of educational level the results revealed that 28% of the respondents were illiterate, almost one-third of the respondents (37.3%) were with

Table 2 Demographic profile of the farmers surveyed (n = 300)

Variable	Frequency (%)/Mean
Age (years)	49.67 (mean)
=> 30	7.0
31–40	23.3
41–50	28.7
51 and higher	41
Education level (%)	
Illiterate	28
Elementary education (1 to 5 years of schooling)	37.3
Secondary education (6–12 years of schooling)	29.7
Academic degree	5
Family's average size	4.88
Average farming experience (years)	25.2

elementary education (1 to 5 years of schooling) degree, and only 5% of them had academic degree educational certification. The farmers' average family size was 4.88 people, and mean farming experience was 25.2 years (Table 2).

4.2 Measurement models

Measurement model was performed using maximum likelihood estimate to ensure the reliability and validity of the model on the data collected. Results show that the TPB and PMT measurement models based on a set of goodness-of-fit indices provided an appropriate fit for the data. The CFI, IFI and TLI significantly for both the TPB and PMT measurement models pass its cutoff value (0.9) (Table 3). In addition, the RMSEA for both measurement models with values less 0.08 shows a good fit (Table 3). The results of assessed convergent validity showed that all the items standardized factor loading in the models (with the exception of two item in the attitude toward the behavior (AB_2 and AB_7) and one items in the response cost (RC_2)) exceeding the recommended value of 0.5 was all significant at 0.001 alpha level (Table 3). Additionally, the AVE and CR values for the entire constructs exceeded the minimum criterion of 0.5 and 0.7, respectively, which they are indicating that the majority of the variance explained by the constructs, and ensuring satisfactory internal consistency among measured items (Table 3). The AVE value for each construct was higher than those of ASV and MSV in two TPB and PMT measurement models supporting acceptable discriminant validity among the constructs (Table 3). Harman's single-factor criterion was used to identify common method bias. According to the Harman's single-factor test, the total variance explained by factor analysis was 24.5%, so since this value was less than the threshold value of 50%, it confirms that no common method bias problem exists in the model (Fuller et al., 2016; Podsakoff, 2003).

4.3 Structural model

In order to examine research hypotheses the three structural model (including TPB, PMT and integrated models) estimated.

Table 3 First-order CFA result

Theory of planned behavior (TPB)				Protection motivation theory (PMT)			
Constructs	Measurement items	Standardized factor lodging* (*t*-value)	Validity and reliability statistics	Constructs	Measurement items	Standardized factor lodging* (*t*-value)	Validity and reliability statistics
Sustainable environment behavior (SEB) In agriculture	Agronomic activities	0.787 (fixed)	AVE = 0.676 CR = 0.893 ASV = 0.164 MSV = 0.240	Self-efficacy (SE)	SE1	0.818 (fixed)	AVE = 0.582 CR = 0.892 ASV = 0.269 MSV = 0.384
					SE2	0.750 (14.286)	
	Horticultural activities	0.815 (15.030)			SE3	0.772 (14.846)	
					SE4	0.614 (11.115)	
	Livestock Activities	0.865 (15.953)			SE5	0.813 (15.927)	
					SE6	0.801 (15.603)	
	Natural Resources Activities	0.830 (15.577)		Perceived Vulnerability (PV)	PV1	0.822(fixed)	AVE = 0.596 CR = 0.911 ASV = 0.258 MSV = 0.314
					PV2	0.732 (14.090)	
					PV3	0.715 (13.653)	
Attitude toward the Behavior (AB)	AB1	0.720 (fixed)	AVE = 0.629 CR = 0.938 ASV = 0.126 MSV = 0.212		PV4	0.783 (15.438)	
	AB2	Dropped					
	AB3	0.753 (12.908)			PV5	0.772 (15.127)	
	AB4	0.706 (12.063)			PV6	0.824 (16.594)	
	AB5	0.834 (14.190)			PV7	0.709 (13.492)	

Table 3 (continued)

Theory of planned behavior (TPB)				Protection motivation theory (PMT)			
Constructs	Measurement items	Standardized factor lodging* (*t*-value)	Validity and reliability statistics	Constructs	Measurement items	Standardized factor lodging* (*t*-value)	Validity and reliability statistics
	AB6	0.828 (14.022)		Perceived Severity (PS)	PS1	0.831(fixed)	AVE = 0.672 CR = 0.924 ASV = 0.202 MSV = 0.314
	AB7	Dropped					
	AB8	0.816 (14.028)			PS2	0.724 (14.211)	
	AB9	0.837 (14.152)			PS3	0.814 (16.826)	
	AB10	0.847(14.362)			PS4	0.842 (17.719)	
	AB11	0.782 (13.396)			PS5	0.878 (18.930)	
Subject norms (SN)	SN1	0.747 (fixed)	AVE = 0.658 CR = 0.905 ASV = 0.099 MSV = 0.130		PS6	0.833 (17.441)	
	SN2	0.793 (13.780)		Response Efficacy (RE)	RE1	0.654 (fixed)	AVE = 0.555 CR = 0.860 ASV = 0.259 MSV = 0.384
	SN3	0.875 (15.511)			RE2	0.796 (11.543)	
	SN4	0.833 (14.732)			RE3	0.807 (11.660)	
	SN5	0.85 (15.013)			RE4	0.827 (11.868)	
Perceived behavioral control (PBC)	PBC1	0.728 (fixed)	AVE = 0.614 CR = 0.888 ASV = 0.105 MSV = 0.194		RE5	0.650 (9.797)	
	PBC2	0.829(13.855)		Response Cost (RC)	RC1	0.932(fixed)	AVE = 0.746 CR = 0.921 ASV = 0.146 MSV = 0.185
	PBC3	0.650 (10.868)			RC2	Dropped	
	PBC4	0.858 (14.320)			RC3	0.792 (18.807)	
	PBC5	0.850 (14.269)			RC4	0.877 (23.460)	
					RC5	0.858 (22.276)	
Intention (IN)	IN1	0.655 (fixed)	AVE = 0.572 CR = 0.868 ASV = 0.169 MSV = 0.240	Intention (IN)	IN1	0.666 (fixed)	AVE = 0.574 CR = 0.869 ASV = 0.257 MSV = 0.314
	IN2	0.825 (11.802)			IN2	0.814 (12.108)	
	IN3	0.770 (11.406)			IN3	0.765 (11.518)	
	IN4	0.865(12.281)			IN4	0.869 (12.701)	
	IN5	0.684 (10.435)			IN5	0.690 (10.550)	

Table 3 (continued)

Theory of planned behavior (TPB)				Protection motivation theory (PMT)			
Constructs	Measurement items	Standardized factor lodging* (*t*-value)	Validity and reliability statistics	Constructs	Measurement items	Standardized factor lodging* (*t*-value)	Validity and reliability statistics
Fit indices of TPB First-order CFA: Chi-square (df) = 507.798 (340); P value = 0.000; Relative Chi-Sq = 1.494; GFI = 0.891; CFI = 0.969; IFI = 0.969; TLI = 0.966; RMSEA = 0.041				**Fit indices of PMT First-order CFA**: Chi-square (df) = 554.468 (480); P value = 0.010; Relative Chi-sq = 1.155; GFI = 0.902; CFI = 0.988; IFI = 0.988; TLI = 0.987; RMSEA = 0.023			

*All factor lading is significantly different from zero at the 0.001 level

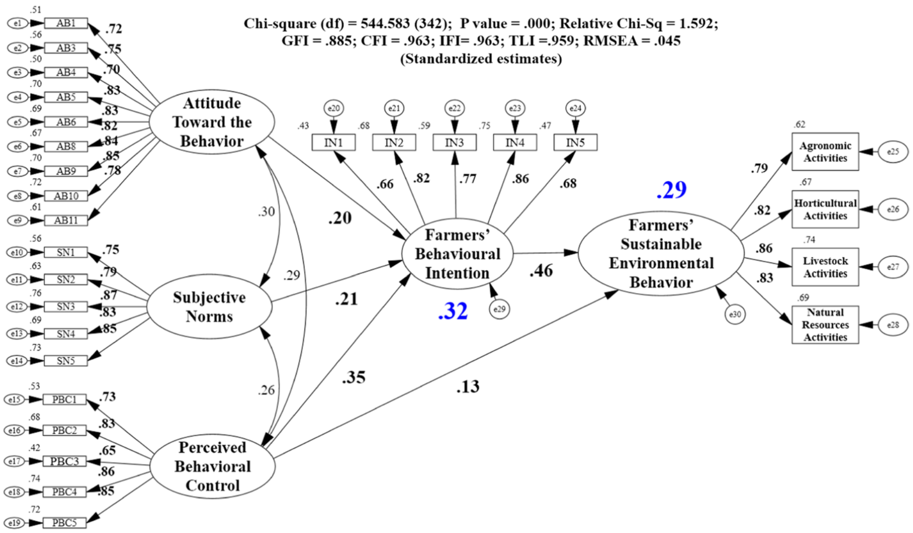

Fig. 2 Significance testing results of the TPB structural model path coefficient. All paths were significance: *** p< 0.001

4.3.1 The TPB structural model

The goodness-of-fit indices showed that the TPB estimated structural model based on the statistical goodness-of-fit indices had a satisfactory fit to data (Fig. 2). According to the TPB structural model the squared multiple correlation (R^2) coefficient of the dependent variables of farmers' sustainable environmental behavior (SEB) and farmers' behavioral intention, respectively, was 0.29 and 0.32, which indicated that 29% and 32% of the variances of the SEB and intention, respectively, were explained by the studied constructs in the model. Moreover, the result shown in Fig. 2 demonstrated that attitude toward the behavior (β=0.204, Sig. = 0.001); subjective norms (β=0.215, Sig. = 0.001); and perceived behavioral control (β=0.349, Sig. = 0.001) had statistically a positive relationship with farmers' behavioral intention. Further, perceived behavioral control (β0.135, Sig. = 0.042) and farmers' behavioral intention (β=0.458, Sig. = 0.001) had a significant positive effect on farmers' agricultural sustainable environmental behavior. Therefore, H1, H2, H3, H4, and H5 were all supported in the TPB structural model.

4.3.2 The PMT structural model

The statistical fit indices of the PMT estimated structural model were acceptable, indicating that the model was satisfactory fit to data (Fig. 3). Moreover, the squared multiple correlation (R^2) coefficient of the dependent variables of farmers' behavioral intention was 44% in the PMT structural model. Further, the result revealed that self-efficacy (β=0.208, Sig. = 0.004); perceived vulnerability (β0.174, Sig. = 0.018); perceived severity (β=0.140, Sig. = 0.038); and response efficacy (β =0.220, Sig. = 0.004) had a significant positive effect on farmers' behavioral intention, whereas the results showed that the response cost (β= -0.136, Sig. = 0.021) had a significant negative effect on farmers behavioral intention. Therefore, H6, H7, H8, H9, and H10 were all supported in the PMT structural model.

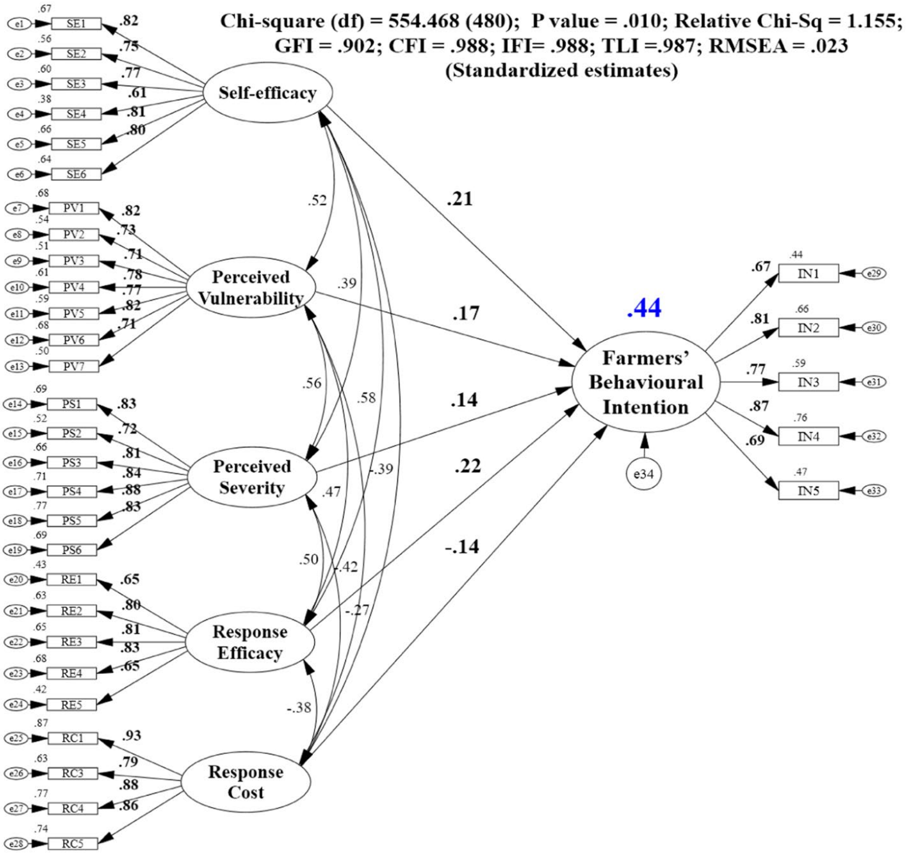

Fig. 3 Significance testing results of the TPB structural model path coefficient. All paths were significance: *** p< 0.001

4.3.3 The integrated structural model

One of the main goals of this study, as stated before, was to extend an integrated model consisting of two theories of TPB and PMT. In this regard, adapted from Wang et al., (2019) study, we developed the integrated model by taking the variable of self-efficacy as the commonality of two theoretical models as shown in Fig. 4. As mentioned earlier, according to Ajzen (1999) planned behavioral model, perceived behavioral control is highly consistent with the concept of self-efficacy (as one of the main variables in the protection motivation model) (Wang et al., 2019). Therefore, in the integrated model, self-efficacy variable was substituted for perceived behavior control, which was considered as the intersection point of the two models. The results shown in Fig. 4 indicated that the integrated structural model based on a set of goodness-of-fit indices provided an appropriate fit for the data [relative Chi-sq. (χ^2/df) = 1.271; CFI = 0.968; IFI = 0.968; TLI = 0.966; RMSEA = 0.030]. Suitable goodness-of-fit indices results for the integrated structural model confirm the appropriateness of the combined approach of the two theories.

Moreover, the results showed that the integrated model increased the amount of explained variance of farmers' behavioral intention variable (R^2 = 52%) compared to

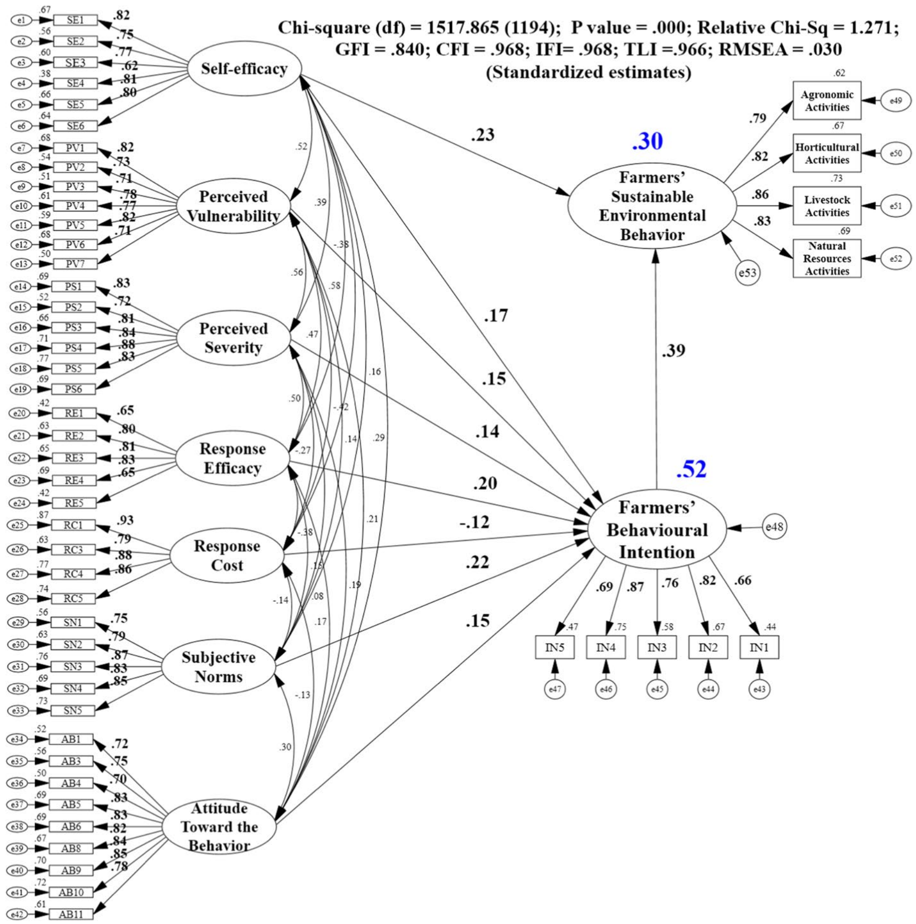

Fig. 4 Significance testing results of the structural model path coefficient an integration of TPB and PMT. All paths were significance: * p<0.05

the explanation of variance of this variable in two separate models of TPB (with 32% variance) and PMT (with 44% variance). However, based on the integrated model, the explanatory variance of the dependent variable of SEB of farmers has increased by only 1% (30% in the integrated model versus 29% in the TPB). Hence, the hypothesis that this integrated model is more suitable and explanatory than the separate models (H11) is confirmed.

Furthermore, the result revealed that the TPB (including AB and SN) and PMT variables (comprising SE, PV, PS and RE) in the integrated structural model had statistically positive effect on farmers' behavioral intention (except RC with a significant negative effect). More importantly, the results, based on the integrated models, illustrated that self-efficacy ($\beta = 0.219$, Sig. = 0.001) as a point of intersection of two theories (TPB and PMT) had a direct, positive and significant effect on farmers' agricultural sustainable environmental behavior (Fig. 4). Therefore, H12 was supported in the integrated structural model. This finding implies that the integrated model is more suitable for predicting the farmers' behavioral intentions and SEB.

Table 4 The results of estimating mediation effect of IN on the relationship between TPB and PMT variables with SEB

Indirect path	Point estimate Standardized indirect effects	S.E.	Bootstrap		
			*BC Percentile 95% CI		
			Lower	Upper	Two-tailed significance (BC)
SE→ IN →SEB	0.064	0.034	0.013	0.148	0.015
PV→ IN →SEB	0.059	0.031	0.010	0.136	0.020
PS→ IN →SEB	0.053	0.030	− 0.004	0.117	0.061
RE→ IN →SEB	0.077	0.033	0.014	0.146	0.015
RC→ IN →SEB	− 0.045	0.023	− 0.096	− 0.004	0.031
SN→ IN →SEB	0.083	0.026	0.040	0.140	0.004
AB→ IN →SEB	0.057	0.023	0.024	0.117	0.002

SEB: sustainable environmental behavior; IN: intention; SE: self-efficacy; PV: perceived vulnerability; PS: perceived severity; RE: response efficacy; RC: response costs; SN: subjective norm; AB: attitude toward the behavior. *BC = bias-corrected confidence interval is 5,000 bootstrap samples that were requested

Finally, we employed a bootstrap technique to examine the mediation effects of the variable of farmers' behavioral intention in the integrated model in the relationship between SEB (as dependent variable) and TPB and PMT (as independent variables). In order to run the bootstrap analysis, as recommended by Hayes (2009), 5000 bootstrap samples with a 95% percentile-confidence intervals were requested and drawn by default with replacement from the original data set of 300 cases. The results of the bootstrapping method suggested that the sum of indirect effects of TPB variables including AB ($\beta = 0.057$, Sig. = 0.002) and SN ($\beta 0.083$, Sig. = 0.004) on SEB of farmers through farmers' behavioral intention was positive and significant (see Table 4). Additionally, the result of bootstrap analysis revealed that the sum of indirect effects of PMT variables including SE ($\beta = 0.064$, Sig. = 0.015); PV ($\beta = 0.059$, Sig. = 0.020); and RE ($\beta = 0.077$, Sig. = 0.015) on SEB of farmers through farmers' behavioral intention was positive and significant and for RC ($\beta = -0.045$, Sig. = 0.031) it was negative significant (see Table 4). However, the PS (β = 0.053, Sig. = 0.061) effect on SEB of frames through farmers' behavioral intention was not statistically significant. Therefore, H13 was supported based on the integrated structural model and the farmers' behavioral intention mediates the relationship between TPB and PMT variables (except RC) and SEB of farmers as endogenous variable.

5 Discussion

The integrated theoretical framework of TPB and PMT significantly explained the SEB of farmers in Zanjan County. Since the integrated model was fit the data and explained additional variance, thus integrating two theories provided a better understanding of farmers' behavioral intention and SEB.

Findings revealed that intention was identified as an essential and significant mediator to determine the farmers' SEB, which is consistent with previous studies (Hlaing, 2016; Macovei, 2015; Wang et al., 2018; Wauters et al., 2010). Further, farmers' behavioral intention in the integrated model has been found as the main predictor (β=0.39) of the farmers' SEB. Consistent with the results, Li & Cai (2012) stated that people's intentions are the best direct determinant of behavior. However, the farmers' behavioral intention to preserve the environment on the farm depends on many factors (Maleksaeidi & Keshavarz, 2019). From among the investigated variables influencing intention, farmers' SN has been witnessed as the highest positive and significant predictor (β=0.22) and indirect dominant predictor (β =0.083) of farmer s' SEB. Therefore, according to the results, farmers are more likely to participate in SEB, where they perceive more social pressure in favor of environmental protection. Consistently, the results of previous studies confirmed that individual/group norm affects people's behavior (Deng et al., 2016; Macovei, 2015; Paul et al., 2016; Shi et al., 2017; Wang et al., 2019; Yanakittkul & Aungvaravong, 2020). In this regard, social cooperation helps to struggle with the negative effect of environmental degradation and unsustainable behavior (Chakraborty et al., 2021). The farmers' attitude toward behavior (AB) is another significant variable (β=0.15) that positively influenced the behavioral intentions and consequently farmers' SEB. In line with what has been stated by Wang et al., (2018), if farmers' attitude towards the outcome of behavior is more positive, then a stronger intention to implement the environmentally sustainable behavior will emerge and eventually the actual behavior (farmers' SEB) will be more likely to occur in agricultural activities.

Findings also showed that the threat appraisal includes two important elements; perceived vulnerability (β=0.15) and perceived severity (β=0.14) had a significant effect on the intention of farmers. Thus, farmers' higher perception of vulnerability and severity is likely to enhance their motivation to perform preventative behavior. These results were consistent with the results of previous studies (Janmaimool, 2017; Keshavarz & Karami, 2016; Steinmetz et al., 2016; Wang et al., 2019; Yoon et al., 2012), where higher farmers' perceived vulnerability to threats led to more confrontational work to prevent the possibility of danger, resulting in less damage to the natural environment.

The results indicated that coping appraisal variables, including self-efficacy (β=0.17), response efficacy (β =0.20) and response costs (β = −0.12), which focuses on responses to deal with the threat, had been found as a significant factor affecting farmers' behavioral intention. Based on the results of the integrated model, self-efficacy which according to Wang et al. (2019) is compatible with perceived behavioral control and is a connecting point of TPB and PMT and had a positive and significant effect on farmers' behavioral intentions (β=0.17) and SEB (β =0.23). The finding is in line with the previous studies, which claim that highly self-efficacy leads to better judgment about the ability and contributes to provide sustainable solutions and willingness to action (Chakraborty et al., 2021; Doran et al., 2015; Keshavarz & Karami, 2016; Le Dang et al., 2014; Yoon et al., 2012).

In other words, farmers' self-efficacy as individual's belief regarding the capability to control environmental behavior in agricultural activities could lead to perform eco-friendly behavior sustainably. The response efficacy significant effect in line with previous studies (Bubeck et al., 2013; Keshavarz & Karami, 2016) refers to farmers' efficacy as an adaptive response to alleviate or avoid the existing environmental risks in agricultural activities. The response cost was only a significant negative predictor variable of farmers' behavioral intention (Janmaimool, 2017; Zhao et al., 2016). It is related to farmers' negative perceptions toward barriers and the existence of costs such as financial, time, efforts, etc., to participate in pro-environmental activities. The importance of cost more specifically in developing countries is related to financial constraints, which cause the increased focus of farmers on short-term goals such as increasing yields instead of long-term goals such as sustainable production and environmental protection (Babu et al., 2018).

6 Conclusion and implication

The agricultural sector is always required to increase the production of agricultural yields, in order to provide the ever-increasing needed food for the growing population, which is mainly associated with various environmental problems such as pollution of water and soil resources and the occurrence of various pests and diseases. These environmental problems in part are related to environmental behavior of farmers. Thus, the current study examined the agricultural sustainable environmental behavior (SEB) and behavioral intention of farmers in agricultural activities in Zanjan county of Iran using PMT and TPB. The results generally confirmed the applicability of the two theoretical models alone to predict farmers' sustainable environmental behavior and behavioral intention. Furthermore, empirical results provided strong evidence supporting the integrated model's suitability to better understand the factors influencing farmers' SEB and behavioral intention compared to applying two models individually. Notably, the findings also showed that self-efficacy (instead of perceived behavioral control) not only had a significant effect on farmers' behavioral intention (according to PMT) but also had a significant direct effect on farmers' SEB. Hence the hypothesis of integrating two social-psychology theories TPB and PMT based on this common point confirmed. Consequently, the higher the self-efficacy level of farmers, the more they identify the goal, estimates the effort, and the more ability to achieve the intended and sustainable environmental behavior. Additionally, concerning the intention as a key determinant, it is noteworthy that it played a mediating role merely on the basis of the TPB model, whereas, based on the integrated model (in addition to the final dependent role in the PMT), it mediates the relationship between SE, PV, RE and RC as significant exogenous constructs of PMT and farmers' SEB. In Iran, the issue of environmental protection has been less considered in rural studies; thus, this study concentrated to fulfill the gap. The study results could help to improve understanding and awareness of politicians and decision-makers on environmental issues in rural areas and the agriculture sector. The results further have a number of practical implications for adopting environmentally sustainable behavior in agricultural activities.

According to the significant role of threat appraisal components (PV and PS), it is suggested to responsible governmental agencies, including the Environment Organization and Agri-Jihad Organization, to provide a deeper understanding for the rural communities about the harms and severity of environmental destruction risk via mass media and social networks. Planning for culture building in rural communities by encouraging the voluntary participation of people and non-governmental organizations in pro-environmental programs can effectively guide and strengthen environmental attitudes and even direct social pressure to reduce actions that are not environment friendly. According to the significant role of attitude and subjective norm, this kind of planning is strongly recommended to executive organizations of agriculture. The significant role of self-efficacy indicates the existence of appropriate intellectual contexts and believes on the ability to perform for sustainable environmental activities among farmers, while, especially in subsistence agricultural of the study area, the negative role of costs is a major limiter. Therefore, it is necessary for extension agencies to strengthen the self-beliefs of the farmers through education and provide the necessary support to reduce the initial costs.

Finally, one of the limitations of the present study is the lack of cooperation of farmers in busy agricultural seasons with the research team. Therefore, based on previous experiences, winter was chosen as the leisure season for farmers to collect data to overcome this limitation. Although the selection of the winter season solved the problem of farmers' cooperation and the farmers were very interested and had enough time to answer the questions, but access to some villages in this season was limited. Therefore, meteorological information was checked before visiting the villages, and local drivers familiar with the area and weather conditions were used. Another limitation of this study was the low literacy level of respondents. To address this problem, questionnaires were completed in the form of interviews by trained interviewers.

For future studies, investigation of economic variables in addition to individual and socio-psychological variables could be proposed in the study of farmers' SEB as response cost showed a negative significant role. Furthermore, the integrated model of PMT and TPB, which in this study found to be a good predictor of farmers' SEB, could be applied in other regions, situations and with different respondents.

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Declarations

Conflict of interest The authors declare no conflict of interest.

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