IGNORING ENVIRONMENTALLY SOUND PRACTICES. FARMERS' MANURE WASTE HANDLING BEHAVIOR AND ITS DETERMINANTS IN TURKEY

GURBUZ, I. B.* – OZKAN, G.

Department of Agricultural Economics, Faculty of Agriculture, Bursa Uludağ University, Görükle Campus, 16059 Nilüfer, Bursa, Turkey

**Corresponding author*
e-mail: bulent@uludag.edu.tr; phone: +90-224-294-1591

(Received 18th Jul 2023; accepted 29th Aug 2023)

Abstract. This paper examines the factors that determine farmers' intention to improve animal waste storage facilities using the Theory of Planned Behavior (TPB). The model was tested using Structural Equation Modelling. Data were collected from 376 small and medium livestock farmers in Turkey. The results showed farmers' intention to improve waste facilities was primarily determined by their attitudes. Subjective norms (SN) and perceived behavioral control (PBC) were almost equally influential. Multiple-Group Analysis determined the effects of control variables. The attitude of less-educated farmers, who owned more extensive livestock operations and relied solely on income from livestock, had a significant and positive effect on the intention to improve farm waste management. SN and PBC were significant determinants of the behavior of farmers' who were more educated, had more prominent families, and employed higher-paid labor. The results will help central and local governments, industry investors, and growers' associations understand farmers' attitudes toward waste storage issues and develop more effective strategies to ensure environmental sustainability and better use of investment and training opportunities.
Keywords: *farmers' attitudes, structured equation modelling, multiple group analysis, sustainable waste management, waste utilization*

Introduction

Livestock production is an essential source of livelihood in developing countries and has strategic importance in economic and social terms. Depending on their capacity, livestock farms generate enormous amounts of manure. Existing research shows that manure management is the main problem on many farms. The cleaning, removal, storage, and disposal of manure is unplanned, inadequate, or ignored altogether (Guler et al., 2017). A study conducted in cattle barns found that 95% of the farms do not store manure but pile it up randomly outside the barn (Cayir and Atilgan, 2012). Varol and Atilgan (2017) surveyed 123 cattle farms and reported that 82.1% do not have manure storage. The solid waste generated is usually spread on farm fields, disposed of on surrounding land or given to neighboring farms, and a small portion is sold, disposed of, or incinerated.

Waste disposal problems and lack of facilities are attributed to several factors. These include the nature of the waste, the physical and socioeconomic characteristics of the livestock farms, the personal and psychological characteristics of those who make important decisions on the livestock farms, and the perceptions and expectations of the future time of the economy. If progress is to be made in waste management, especially in livestock management, the attitudes and intentions of farmers must first be considered in the construction and development of the necessary waste facilities. The construction and management of appropriate agricultural waste storage and disposal

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

facilities will only be possible if intentional behavior is understood. Therefore, the primary purpose of the research is to understand the factors that influence farmers' behavior in storing manure waste. Therefore, the primary purpose of the research is to understand the factors that influence farmers' behavior in storing manure waste. Thus, the Theory of Planned Behavior was used. The theory is considered one of the best predictive models for human behavior and is widely used in many areas of science.

The Theory of Planned Behavior (TPB) assumes that certain factors control individuals' social behavior, that specific reasons are responsible, and that the behavior occurs in a planned manner. Ajzen (1991) explains that attitudes (AT), subjective norms (SN), and perceived behavioral control (PBC) interact to predict intention.

Attitudes toward behavior indicate an individual's positive or negative attitude. Individuals who have a positive attitude are more likely to perform the behavior. Farmers' positive attitude that they can afford the cost of building the facility, their concern for animal welfare, and their belief that the waste is a threat to their animals, the environment, and the surroundings will have a direct and positive effect on their decision to invest in and build the facility. If this attitude is negative, if farmers consider it an unnecessary investment, if their financial situation is insufficient, and if they do not believe they can get a loan or grants, they will have a negative attitude and will not perform the desired behavior.

Attitudes toward a particular behavior result from the expected consequences of that behavior. For example, farmers' positive or negative experiences resulting from previous decisions to build a shelter, apply for a loan or grant, or make on-farm improvements will also positively or negatively influence their attitudes toward building a manure storage facility.

The TPB assumes that subjective norms are shaped by normative beliefs and the individual's motivation to adhere to those norms. Normative beliefs refer to whether reference persons (spouse, family, relatives, friends, consultants.) or groups approve of a behavior. It can also be referred to as perceived social pressure, which motivates the person to perform the behavior (Ajzen, 1991). In other words, the thoughts of the people around the person influence the person's intention to perform a behavior. Farmers often live in small communities scattered around remote areas. These are closed communities where traditions are strong and social networks are still close-meshed. Smallholders want to act within the behavioral patterns of their communities. Therefore, the influence of subjective norms on behavior in farming societies is strong. Several studies using TPB show that subjective norm explains behavioral intention (Govindharaj et al., 2021).

Perceived behavioral control describes the belief of how difficult or easy it will be for a person to perform a behavior. It is a person's belief that their behavior is under their control. The more a person believes in the possibilities and opportunities to perform a behavior, the more likely the person is to perform the behavior. If the farmer believes that he can quickly get a loan to improve waste management on his farm, if he believes that he has the necessary requirements to apply for a loan, this will positively affect his behavior. Suppose farmers believe they have the knowledge and skills to build or obtain support for the waste management facility. In this case, this belief will positively affect their behavior and determine the intention of Iranian farmers to follow the water conservation policy options. Farmers' incomes were limited, and implementing these policies required high initial investments in most cases, so farmers refrained from adopting such policies. (Mahdavi, 2021). On the other hand, PBC was a

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

weak determinant of olive farmers' intention to participate in agricultural extension programs. Farmers believed that using this service would not bring benefits and opportunities.

Ajzen and Fishbein (2005) emphasize that various cultural, personal, and situational factors influence the performance of a particular behavior. For example, age, gender, ethnicity, socioeconomic status, education, group membership, past experiences, and information about exposure can affect people's behavior.

Gurbuz and Ozkan (2021) conducted a recent study on farmers' intention to transport their manure waste to a designated landfill. However, their study did not include demographic characteristics in the model. Research has indicated the impact of farmer and farm characteristics. Therefore, this paper considers and examines the effects of these characteristics. This research focuses on farmers' behavior in improving waste management facilities. In addition, the paper will investigate the effects of sociodemographic (farmer) and socioeconomic (farm) characteristics on attitudes, SN, PBC, and behavior. The study uses the TPB model developed by Gurbuz and Ozkan (2021). Further, the study tests whether the model explains farmers' behavior in the current research setting.

This model is valuable for predicting behavior concerning agricultural and livestock waste. In addition, the research will fill the gap in the waste literature using the TPB model and provide a multifaceted analysis of farmer behavior with the variables that make it used. The results of this study will help livestock cooperatives, educators, veterinarians, extension agents, local planners, licensing municipalities, and policymakers understand farmers' animal welfare behaviors. And their investments. It will help identify and target farmers most likely to adopt this behavior. It can also help identify the legal or financial characteristics of existing monetary or non-monetary support measures and enable them to target the right audience better.

This paper hypothesizes that farmers are more likely to intend to build new manure storage facilities or improve existing ones under the following circumstances. When they perceive a functional manure storage facility to be more beneficial (attitude), when they perceive the social pressure to build this storage facility to be higher (subjective norm), and the more positively they perceive their ability to implement this practice on their farm (PBC).

This research aims to address the following hypotheses:
H1: Attitudes positively and significantly affect farmers' intentions.
H2: Subjective norms positively and significantly affect farmers' intentions.
H3: Perceived behavioral control positively and significantly affects farmers' intentions.
H4: Farmer (i.e., age, education level, family size, non-livestock income) and livestock business (i.e., farm ownership, number of cattle, labor force, livestock income, breeding experience) characteristics affect farmers' manure storage intentions.

Materials and methods

The study area

Turkey has a population of 85 million people (Turkstat, 2023). Due to favorable climatic conditions and very fertile soils, it allows intensive agriculture and livestock breeding. The study focuses on four provinces of Turkey that are leading in terms of livestock. The three provinces, Bursa, Balıkesir, and Canakkale, are in the southern Marmara region, while Kutahya is located in the north of the Aegean region.

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

Sampling

A stratified sampling method is used in which each province is treated as a subgroup (strata). This method allows the researcher to draw more accurate conclusions by ensuring that each subgroup is represented adequately in the sample. In 2022, 149 769 farmers were members of the Cattle Breeders Association, and 336 150 were members of the Sheep and Goat Breeders Association in Turkey (Turkstat, 2018). Therefore, the sample size (n = 376) was determined using the formula developed by Scheaffer et al. (1979).

Survey development

The first step was to test the validity of the model developed by Gürbüz and Özkan (2021). Preliminary semi-structured interviews were conducted in September 2021 with five farmers in Balıkesir province, where livestock production is most intensive in the region. These interviews were analyzed, and the final survey was developed. A panel of agricultural and environmental experts checked the face validity. A pilot study was conducted with final-year students of the Faculty of Agriculture. The survey was conducted through individual interviews with the farmers. Each statement in the survey was read out to the farmers. Additional comments from the farmers were also noted.

Data collection

The survey was conducted between April and December 2022 and consisted of three parts. The first part included the demographic characteristics of farmers. The second part contained questions on land ownership and size, farm size, number of animals, breeds, weight, amount of manure waste generated, handling and disposal methods, and waste storage capacity. The third part contained statements on measuring the latent constructs of the TPB models. Attitude, intention, subjective norms, and PBC are the latent constructs measured in the original TPB model (Ajzen, 2012). Each of these constructs was measured with statements on a five-point Likert scale with possible responses ranging from "1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; to 5 = strongly agree" in the last part of the questionnaire. The scale included 20 statements: five questions measuring each construct of the TPB model. The descriptive statistics of the TPB model and the measurement model results are presented in *Table 1*.

Statistical analysis

Exploratory factor analysis (EFA) was conducted to test construct validity. Thus, factor loadings were checked to ensure that items were assigned to the correct construct. Factor analysis is a multivariate statistical technique that combines many correlated variables into a small number of significant and uncorrelated variables. Before starting the factor analysis, Tabachnick and Fidell (2007) suggested examining the correlation matrix (often known as the Factorability of R) for correlation coefficients greater than 0.30. The researcher should reevaluate whether factor analysis is the best statistical technique to use if there are no correlations that exceed 0.30. In addition, a partial correlation between them should be considered. A high partial correlation means no underlying factor, which makes the analysis invalid. Factor analysis will not give accurate results if the partial correlation is 0.7 and above. Factor loading close to -1 or 1 illustrates that the factor strongly influences the variable.

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

Table 1. *TPB statements and main descriptive statistics*

Item statistics*		Statements	
x̄	SD	Code	Explanation
Intention (Ajzen, 2012; Borges et al., 2016; Yazdanpanah et al., 2014) CV = 0.133 x̄ = 3.920 SD = 0.521 α = 0.752			
4.00	0.635	IN1	Planning to improve WSDF**
3.86	0.672	IN2	Strongly advise others to improve WSDF
4.10	0.586	IN3	Intend to improve WSDF on the farm
3.93	0.670	IN4	Willing to support fellow farmers to improve their WSDF
3.71	0.776	IN5	Strive to develop WSDF on my farm
Attitude (Ajzen, 2012; Maleksaeidi and Keshavarz, 2019; Meijer et al., 2015) CV = 0.146 x̄ = 4.045 SD = 0.590 α = 0.841			
4.00	0.685	AT1	Animal manure should be arranged by the municipality along with other wastes
3.99	0.667	AT2	Farmers' priority is not to deal with waste management but to increase crop efficiency and farm profitability
4.06	0.683	AT3	Farmers' information and raising awareness about waste management is an important issue
4.08	0.674	AT4	Building such units will make it more difficult to manage my farm
4.09	0.691	AT5	Building waste disposal units needs a high investment
Subjective norms (Francis et al., 2004) CV = 0.213 x̄ = 3.606 SD = 0.767 α = 0.918			
3.56	0.887	SN1	If more farmers improve their WSDF, I will also try to improve mine
3.73	0.816	SN2	If the government subsidizes WSDF, I will do my best to join those efforts
3.38	0.950	SN3	The way that other farmers deal with livestock manure is important to me
3.64	0.852	SN4	If I managed the waste on my farm better, the people who are important to me would approve it
3.72	0.857	SN5	Other farmers around my village have WSDF, I want to be like them
Perceived behavioral control (Ajzen, 1991; Francis et al., 2004; Maleksaeidi and Keshavarz, 2019) CV = 0.262 x̄ = 2.869 SD = 0.753 α = 0.863			
2.74	0.830	PBC1	I can manage manure waste in an environmentally friendly way
2.86	0.892	PBC2	Disposing of manure waste is a hard job for me
2.72	0.882	PBC3	The decision to improve WSDF on my farm is up to me
3.00	0.939	PBC4	I have sufficient money and time to improve WSDF on my farm
3.02	0.944	PBC5	I have sufficient knowledge, skill, and experience to improve WSDF on my farm

*CV: Coefficient of variance; SD: Standard deviation; x̄: Mean; α: Cronbach's alpha
**WSDF = Waste Storage and Disposal Facilities

EFA was performed after valid results were obtained from the tests. The maximum likelihood extraction method and varimax rotation were used to characterize components. The eigenvalue is a coefficient considered in calculating the variance the factors explain and deciding the number of essential factors. Factors with an eigenvalue greater than one are considered significant. In the TPB model composed, the percentage of total variance explanation was 71.392. Based on the above rule of thumb, three factors in the TPB model are retained.

Cronbach's alpha was calculated to test the model's internal consistency, and the constructs of the model meet the criteria for reliability and validity (Gurbuz and Ozkan, 2019). Generally, Cronbach's Alpha value is expected to be above 0.7 (Nunnally, 1978). The closer the coefficient value is to 1, the higher the internal consistency of the items in the scale (Hair et al., 2010).

The next test for suitability for factor analysis is the Bartlett Test. The Bartlett test examines the previous correlation matrix and the statistical significance. This test is expected to be significant ($p < 0.05$). Bartlett's test was significant at the $p = 0.0000$ level. The last step is to check the KMO value. The KMO test measures correlations between variables and the suitability of factor analysis. The KMO value should be in the

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

range of 0 to 1. Values above 0.8 can be considered perfect. The result of the KMO was 0.908 for the model (TPB). Thus, we can say that the data obtained in the study was suitable for EFA.

Confirmatory factor analysis (CFA) was conducted to assess the adequacy of a given model by evaluating model fit, convergent validity, discriminant validity, and reliability. Second, the structural equation model (SEM) and Amos software (version 22.0) were used. SEM is a commonly used method to test theories and develop new models. SEM performs many analyses simultaneously, recommends new arrangements for the network of relationships, and accounts for measurement errors (Anderson and Gerbing, 1988). After checking the adequacy of the measurement models, we used the variables derived from the CFA of the survey data for the related analysis. The commonly reported fit indices for CFA and SEM are shown in *Table 2*. The values derived from the TPB model, the chi-square value was 221.456 and significant ($p = .0013$, $p < 0.005$). The CFA fit indices for the TPB model were calculated as follows: $\chi 2/df = 1.112$, RMSEA = 0.017, NFI = 0.966, NNFI = 0.997, CFI = 0.996, IFI = 0.997, SRMR = 0.0336, GFI = 0.952, AGFI = 0.933. Thus, the CFA results of the developed model met the criteria of reliability and validity. The analyses support the adequacy of the proposed TPB model in predicting farmers' intentions.

Table 2. *Benchmarks and values of the model fit indicators*

Fit ranges	Fit indices	Good fit	Model values
א2/df		0 ≤ א2/df ≤ 2	1.112
RMSEA	Root Mean Square Error of Approximation	RMSEA < 0.08	0.017
NFI	Normed Fit Index	NFI ≥ 0.95	0.966
NNFI	Non-Normed Fit Index	NNFI ≥ 0.95	0.997
CFI	Comparative Fit Index	CFI ≥ 0.90	0.996
SRMR	Root Mean Square Error of Approximation	SRMR < 0.05	0.034
GFI	Goodness of Fit Index	GFI ≥ 0.95	0.952
AGFI	Adjusted Goodness-of-Fit Index	AGFI ≥ 0.90	0.933
IFI	Incremental Fit Index	IFI ≥ 0.90	0.997

Convergent validity (CV) was tested, and almost all factor loadings were above 0.7, statistically significant at $p < 0.001$. The exception is that the factor loading of item Int1 was 0.678, and PBC5 was 0.678. However, the loading is very close to 0.7, and all other item loadings with significant results indicate a functional contribution of the items to the three TPB dimensions (Chin, 1998). The TPB model's composite reliability (CR) values ranged from 0.843-0.927. The results indicate a good level of reliability (CR > 0.7), and the average variance extracted (AVE) is > 0.5, which means that more than half of the constructs explained the indicators. The proposed TPB model obtained approved CV and CR values. The discriminant validity was determined by assessing the maximum shared variance (MSV) and the average shared squared variance (ASV), both lower than the AVE for all the factors (Fornell and Larcker, 1981). Based on the results in *Table 3*, the model measurement has construct validity and reliability.

Multiple group analysis is a valuable tool for testing whether the same theoretical model can be applied in predefined groups by conducting separate studies for each group and estimating group-specific parameters. It is commonly used to fit a consistent

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

model simultaneously to two data sets representing two groups (e.g., male and female). In this way, we can compare the results of the estimation. Thus, the effects of categorical variables can be calculated by comparing the coefficient estimates between groups (Hair et al., 2010). The "Multiple-Group Analysis" function in the software AMOS was used to determine the effects of four farmer control variables (i.e., age, education level, family size, non-livestock income) and five livestock farm control variables (i.e., farm ownership, number of cattle, labor force, livestock income, breeding experience) on farmers' intention for the manure.

Table 3. *Constructs/variables, measuring statements, and first-order CFA analysis*

Construct	ITEM	Loadings	t-value	AVE*	CR*	MSV*	ASV*
Intention	IN1	0.678	10.480	0.521	0.843	0.324	0.12
	IN2	0.735	Fixed				
	IN3	0.743	13.276				
	IN4	0.745	13.734				
	IN5	0.826	14.178				
Attitude	AT1	0.894	22.358	0.717	0.927	0.289	0.48
	AT2	0.902	21.329				
	AT3	0.840	Fixed				
	AT4	0.829	19.723				
	AT5	0.799	18.618				
Subjective norms	SN1	0.714	17.322	0.689	0.916	0.324	0.24
	SN2	0.737	18.276				
	SN3	0.825	22.640				
	SN4	0.958	30.299				
	SN5	0.917	Fixed				
Perceived behavioral control	PBC1	0.887	Fixed	0.632	0.894	0.257	0.23
	PBC2	0.860	22.173				
	PBC3	0.782	17.760				
	PBC4	0.903	20.983				
	PBC5	0.670	13.109				

*AVE: Average variance extracted; CR: Composite reliability
MSV: Maximum shared variance; ASV: Average shared squared variance

Results

Descriptive statistics

Men usually take care of waste, so most of the participants in our survey (76.1%) were male. More than half of the respondents (57.1%) were 46 years and older. The average age of farmers in Turkey is 52 years (KKB, 2022). Therefore, our sample corresponded to the population of all livestock farmers in Turkey. The educational level of farmers was low. A significant proportion of participants (52.7%) had only primary education. The average family size was four persons. More than two-thirds of the participants (66.2%) lived solely on their farm income, and a similar percentage (65.7%) owned a farm. The majority of households owned land (77.9%). Slightly more than 10% of farmers employed three or more paid workers. This indicates that the participants were small-scale farmers. The approximate herd size was 5.9 cattle, and 25.9% of the total farms are 20 to 49 cattle in Turkey. In this study, 28.1% of the farms had 26-50 cattle, and the income of about half was just above the legal minimum monthly income. The participant characteristics were similar to the 2016 Agricultural

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

Enterprise Structure Survey (Turkstat, 2018). The main characteristics of the respondents are shown in *Table 4*.

Table 4. *Demographic results of the survey*

Index	Min-Max	Frequency %	Mean	Sd
Gender	Male (=1) Female (=2)	76.1 23.9	1.24	0.427
Age	20-35 (=1) 36-45 (=2) 46-55 (=3) 56-65 (=4) 66 + (=5)	19.4 23.4 27.9 22.3 6.9	3.73	1.213
Education	Unschooled but Literate (=1) Primary School (=2) Secondary School (=3) High school (=4) University (=5)	3.2 52.7 23.4 18.6 2.1	2.80	1.77
Family size (persons)	1-2 (=1) 3 (=2) 4 (=3) 5 (=4) 6 (=5)	15.2 26.6 36.7 13.3 8.2	2.73	1.125
Gross annual farming income ($)**	0-5 000 (=1) 5 001-10 000 (=2) 10 001-15 000 (=3) 15 001-20 000 (=4) 20 001 + (=5)	21.0 43.4 17.6 10.6 7.4	2.40	1.150
Non-livestock income	Yes (=1) No (=2)	33.8 66.2	1.66	0.474
Farm ownership	Owner (=1) Rented (=2) Owner + Rented (=3)	65.7 22.1 12.2	1.47	0.703
Cattle number	0-25 (=1) 26-50 (=2) 51-75 (=3) 76-100 (=4) 101 + (=5)	44.7 28.2 17.6 7.6 2.1	2.99	1.508
Number of paid workers	1 (=1) 2 (=2) 3 (=3) 4 (=4) 5 + (=5)	59.8 29.3 7.7 1.6 1.6	1.56	0.831

*The minimum wage was gross $302 and net $257 between 1.1.- 30.06 2022
The minimum wage was gross $391 and net $332 between 1.7.- 31.12 2022

Item measurement

Table 1 presents the descriptive statistics of the TPB model and the measurement model results. The analysis revealed that attitude towards the behavior is the most important determinant of behavioral intention. The mean value of attitude of $\bar{X} = 4.05$ (the highest value is five) (SD = 0.590) shows that farmers have a healthy positive

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

attitude. Any behavior that is to be changed first requires a positive attitude. The very positive attitude of farmers indicates that they will be favorable towards any support, campaign, or encouragement to improve waste management on their farm. Behavioral intentions capture how hard people are willing to make an effort to perform a behavior (Azjen, 1991). In the TPB, behavioral intention is the most influential predictor of behavior. Farmers' intention to utilize manure waste was very strong. ($\bar{x}$ = 3.920 SD = 0.521). Farmers also reported high subjective norms ($\overline{X}$ = 3.606, SD = 0.767) and moderately high perceived behavioral control ($\overline{X}$ = 2.869, SD = 0.753) towards improving farm waste management facilities.

Participants are generally inclined to improve the waste facilities on their farms ($\bar{x}$ = 4.10), strongly advise other farmers to improve their waste facilities ($\bar{x}$ = 3.86), and are willing to support them if they want to improve their waste facilities ($\bar{x}$ = 3.93), However, when it comes to developing such facilities, their intention decreases slightly ($\bar{x}$ = 3.86), Nevertheless, farmers' intention to improve manure waste still high.

The participating farmers were of the opinion that the construction of a disposal facility requires a high investment ($\bar{x}$ = 4.09). Most of them are smallholder farmers and have limited financial resources. They use their resources for more important work such as planting, harvesting, or spraying. The construction of waste disposal facilities requires regular maintenance, which means more time and work. Consequently, they believe building waste disposal facilities makes their farm more difficult to manage ($\bar{x}$ = 4.08). Research shows that some farmers randomly dispose of their manure and expect municipalities to remove this waste (Ozocak, 2019). Some municipalities collect animal and vegetable waste and set up biogas plants. This application led more and more farmers to believe that the municipality should dispose of manure along with other waste ($\bar{x}$ = 4.00). Turkish farmers believe that their priority is to increase crop efficiency and farm profitability, not to deal with waste disposal ($\bar{x}$ = 3.99).

The subjective norm measures the perceived social pressure to engage or not engage in specific behaviors. The effect of subjective norms is slightly weaker than attitude. Farmers will build manure waste facilities if the local or central government provides subsidies ($\bar{x}$ = 3.73). This is understandable, given that farmers have limited means and high costs. Farmers indicated that it would be an incentive for them if a neighboring farmer had a waste facility, in which case they would want to follow their example ($\bar{x}$ = 3.73). This is understandable, as farmers have limited funds and high costs. Farmers indicated that it would be an incentive for them if a neighboring farmer had a manure disposal plant; in that case, they wanted to follow their example. On the other hand, it was a striking contrast that farmers scored the lowest mean when they indicated that it is important to them how other farmers deal with their manure waste ($\bar{x}$ = 3.38). It could be argued that the social desirability effect comes into play here, albeit partially. When it comes to social identity, farmers tend to give the expected answer from them.

PBC scored the lowest. Farmers with high PBC are expected to be motivated to improve manure waste facilities and persist in their attempts. In contrast, farmers with low PBC are less motivated to utilize manure waste, and their attempts are short-lived (Yzer, 2012). Low PBC is the farmer's perception that he lacks the resources and opportunities to construct and manage a manure waste plant is burdensome. Hence, farmers were not confident that they had sufficient knowledge, skill, and experience to improve waste storage facilities on their farms ($\bar{x}$ = 3.02). They did not think they had sufficient money and time to improve waste storage facilities ($\bar{x}$ = 3.00) and could manage manure waste in an environmentally friendly way ($\bar{x}$ = 2.869).

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

Structural model

TPB produced significant results in determining behavioral intention within the theoretical framework of this study. Literature often indicates that a positive attitude is needed first and foremost for any behavioral change. The study also shows that attitudes (their constructive or prejudicial judgments) were the driving factor of intention and significantly and positively affected farmers' intentions to improve on-farm waste management facilities (H1: $\beta = 0.31$, $p < 0.01$). SN (H2: $\beta = 0.25$, $p < 0.01$) and PBC (H3: $\beta = 0.23$, $p < 0.01$) have a similar effect on a farmer's intentions, but the impact of SN is relatively more substantial (*Table 5*). The findings proved that all three constructs demonstrate farmers' intention to adopt and improve their waste facilities statistically, significantly, and positively. Therefore, the proposed hypotheses 1, 2, and 3 are valid and supported.

Table 5. *SEM estimation and hypothesis test*

	Unstandardized path coefficient	**Standardized path coefficient**	**SE**	**CR**	**p**
H1: IN ←AT	0.319	0.313	0.045	7.094	***
H1: IN ← SN	0.321	0.247	0.063	5.113	***
H2: IN ← PBC	0.345	0.234	0.072	4.767	***
R^2	0.522				

Multiple group analysis

Current research has found that farmers' decisions are also influenced by their characteristics, such as gender, age (Fielding et al., 2008), and income level (Chaudhary et al., 2017). Farm-related characteristics include farming experience (Jiang et al., 2018) and farm or land size (Despotovic et al., 2019). Farm group membership, kinship, farm labor (Meijer et al., 2015), network size, water charges, and previous training (Rezaei et al., 2019) can also influence farmers' decisions. Bootstrap resampling analyses were conducted with 5000 bootstrap samples per group, as suggested by Hair et al. (2010). The results are presented in *Table 6.*

The estimation results showed that for the older, less educated farmers who owned the farm and lived solely on income from livestock, their intentions to build slurry storage facilities were positively influenced by their attitude compared to their fellow farmers. For farmers with high income, less farming experience, or higher paid labor, their subjective norms significantly and positively influenced their intentions. In contrast, for farmers who rented the farm, and had a smaller herd or lower income, the standardized path coefficients of PBC on their intentions were extremely low and not statistically significant. These results were consistent with the TPB model presented in *Table 5*.

Discussion

This research examined livestock farmers' intentions to build waste storage facilities or improve their existing waste facilities to prevent farm manure from causing human health, animal welfare, and environmental pollution.

Farmers do not attach the necessary importance to the construction and maintenance of manure in their farm plans. However, manure can create an income. Vermicompost

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

can be produced from fertilizer and used as a bio-fertilizer and bio-pesticide in organic agriculture. Biogas can also be produced from manure to produce electricity and heat. In 2021, the amount of fertilizer from cattle in Turkey was calculated as 147 846×10^6 tons/year, the amount of fertilizer from sheep and goats as 33 591×10^6 tons/year, and the amount of fertilizer from poultry as 6 539×10^6 tons/year. Biogas potential of these wastes was calculated as 13 955×106 m^3/year for cattle, 436×10^6 m^3/year for small cattle, and 1 503×10^6 m^3/year for poultry. The electricity potential from animal manure is 28 609×10^6 kWh/year (Unvar, 2023). For this to happen, first, manure must be collected and stored appropriately.

Table 6. *Multiple-group analysis results*

Path	Age			Educational level			Family size		
	β		χ^2	β		χ^2	β		χ^2
	Young[1]	Old[2]		Low[3]	High[4]		Small[5]	Large[6]	
H1:IN ← AT	0.284***	0.348***	0.049**	0.391***	0.205**	4.279*	0.302***	0.368***	0.370
H2:IN ← SN	0.222**	0.253***	0.108	0.219***	0.296***	0.211	0.303***	0.038	5.893*
H3:IN←PBC	0.359***	0.138*	4.233	0.212***	0.262***	0.010	0.209***	0.336**	0.917
	Livestock income			**Non-livestock income**			**Number of employees**		
	β		χ^2	β		χ^2	β		χ^2
	Low[7]	High[8]		Yes	No		Few[9]	More[10]	
H1:IN ← AT	0.236	0.443***	4.769*	0.206*	0.376***	4.919*	0.293***	0.418***	0.605
H2:IN ← SN	0.305***	0.152*	1.647	0.26**	0.244***	0.041	0.291***	0.002	4.209**
H3:IN←PBC	0.244***	0.236**	0.026	0.289**	0.196***	0.294	0.193***	0.497***	4.479**
	Breeding experience			**Farm ownership**			**Number of cattle**		
	β		χ^2	β		χ^2	β		χ^2
	Less[11]	More[12]		Own	Rent		Small[13]	Large[14]	
H1:IN← AT	0.183**	0.428***	6.165**	0.28***	0.424***	3.967**	0.23***	0.385***	7.001**
H2:IN← SN	0.275***	0.236***	4.311**	0.22***	0.26**	0.291	0.252***	0.262***	0.752
H3:IN←PBC	0.318***	0.165**	0.52	0.302***	0.073	2.901	0.292***	0.184**	0.239

***, **, *, significant at 1%, 5% and 10%, respectively
[1]Age 45 and below; [2]Aged above 45; [3]Primary education and below; [4]Secondary education or above; [5]3 or fewer family members; [6]More than three family members; [7]Gross annual income at or below $10 000 $; [8]Gross annual income over $10 000; [9]Employment of two or fewer farm laborers; [10]Employment of three or more farm laborers; [11]15 years and less experience; [12]Over 15 years experienced group; [13]50 and fewer cattle; [14]More than 50 cattle

The existing research shows no manure storage facilities in almost all enterprises; thus, no additional income can be provided. According to the research, approximately 55% of the fixed investment costs in the newly established dairy cattle enterprises are allocated to constructing the barns. (Alpan and Aksoy, 2015). Most shelters are built without a project to reduce the building cost. Farms are often modeled after neighboring barns and inherited existing mistakes and problems. Sirin and Kocaman (2016) highlight that farmers care for their animals, feed them well, and call the veterinarian regularly. They are susceptible to diseases because animals are expensive (they make a significant investment), but they do not take the necessary care to build healthy barns. Several studies in Turkey have reported that most animal shelters and auxiliary units (including manure storage and manure pits) were built without technical knowledge (Boyaci et al., 2011; Guler et al., 2017; Mundan et al.,2018; Gurbuz and Ozkan, 2021). Only 5-20% of the existing shelters were built on the project (Peypazar and Kilic, 2021; Mundan et al., 2018). Farmers built shelters on their own experience at a rate of 50-85% or take neighboring shelters as examples (Bakir and Kibar, 2020; Guven, 2021). Manure storage facilities are most neglected in farms with unplanned shelters.

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

Concerns for human health and the environment and increased sensitivity to animal welfare led to a generally positive attitude ($\beta = 0.313$ $p < 0.001$) toward waste management. Farmers generally have a positive attitude toward making the necessary investments for farm operations or undertaking policies that aim to remedy environmental conditions. This result is consistent with the literature.

Attitudes were the most critical component to manifest adoption behavior ($\beta = 0.385$, $p < 0.001$) for a farmer in Punjab in the context of their sustainable practices in response to climate change (Faisal et al., 2020). Iranian farmers' intention to adopt water policy options has a positive relationship with farmers' attitudes toward the water policy option (Mahdavi, 2021). Brazilian farmers' intention to diversify their agricultural production was directly ($\beta = 0.575$) and indirectly ($\beta = 0.578$) influenced by their attitude (Senger et al., 2017).

Farmers in Turkey primarily rely on their experience when building animal shelters and manure storage units. However, the farmer's experience is also influenced by the practices in neighboring farms. Farmers agreed that 'the way that other farmers deal with agricultural waste is important' for them. Furthermore, if more farmers in their neighborhood improve farm waste facilities, they would improve theirs. The fact that all farmers expect other farmers to take the lead and see tangible results of doing it. Since all neighboring farms also mismanage their manure waste, this leads to reasons for the current undesirable situation. The farmer does not feel social pressure or care about manure management.

The number of farms that consult with the extension agent and build shelters with plans and projects is rare. Shelters and auxiliary units are only planned and licensed to meet the requirements of grant or loan institutions. Farmers may be exposed to the reaction of fellow farmers, veterinarians, and extension agents on more obvious issues, such as the state of shelters and animal treatment, and may feel social pressure on these matters. Institutions and individuals, such as cooperatives, veterinarians, village heads, and mayors, who are expected to act as opinion leaders in the society and influence the farmers, also focus on more obvious problems that require immediate solutions. Therefore, since the social pressure in the form of appraisal or encouragement from these sources remains weak, the effect of subjective norms on behavior is relatively reduced.

Perceived behavioral control describes the belief in how difficult or easy it will be for a person to perform a behavior. It is a person's belief about the extent to which his/her behavior is under his/her control. The more an individual believes in possibilities and opportunities to perform a behavior, the greater the probability that the individual will perform the behavior. If the farmer believes that he can easily get a loan to improve the waste facilities on the farm, if he believes that he has the necessary conditions for a loan application, this will reflect positively on his behavior. If farmers believe they have the knowledge and skills to build the waste facility or get support, this belief will reflect positively on their behavior.

According to Ajzen (1991), the intention to perform behavior increases with the positive perception of behavioral control. Ajzen (1991) also underlines that individuals can only perform the desired behavior in cases with the necessary resources and opportunities. In the current study, as in other studies conducted with farmers, perceived behavioral control was weak in making investment decisions. Farmers often believe building or improving manure waste facilities will be burdensome under current operating conditions. Farmers with a low level of education and a lack of financial

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

security have low self-confidence. The grants and support given to farmers do not cover farm waste. Plan and project support services are not widespread, and these service fees and construction costs are high. These factors weaken farmers' beliefs about creating the necessary resources and opportunities, leading to a weak PBC. While farmers' attitudes greatly influence their behavior, there is a significant and reciprocal relationship between SN ($\beta = 0.25$, $p < 0.01$) and PBC ($\beta = 0.23$, $p < 0.01$) in rural communities.

The current studies provide evidence to support this phenomenon. Sukhmani and Gupta (2017) have shown in India that attitudes ($\beta = 0.32$) were the most conclusive factor in farmers' intentions to set up or develop agricultural waste processing plants, followed by social norms ($\beta = 0.19$) and perceived behavioral control ($\beta = 0.14$). Borges et al. (2016) used TPB to identify fundamental beliefs underlying Brazilian cattle farmers' intention to use improved natural grassland. The effect size of attitude ($\beta = 0.477$; $p < 0.01$) was highest, followed by subjective norms ($\beta = 0.237$, $p < 0.01$) and perceived behavioral control ($\beta = 0.228$, $p < 0.01$).

Several factors influence farmers to evaluate agricultural waste, establish waste management facilities, or expand existing facilities. These include the farm's characteristics, the community's socioeconomic characteristics, the specifications of the waste facility to be constructed, the personal and psychological characteristics of those who make key decisions on the farm, their perceptions and economic outlook, and their expectations for the future. The relative effects of these factors vary by farm type and farmer and over time.

Studies have found that older and less educated farmers exhibit positive behavior. Membership rates in water user associations increased as farmers aged (Taqipour et al., 2015). Older Swedish farmers firmly intend to ask professional visitors (veterinarians, technicians, or patrons) to wear protective clothing (Noremark et al., 2016). In addition, older farmers were more reluctant to purchase animals with unknown health status. The same study highlighted that wearing protective clothing decreased as the educational level of visitors increased. Gebrezgabher et al. (2015) found that farmers with lower education levels were more interested in adopting fertilizer separation technologies. These results are consistent with the above studies. Age is a statistically significant factor influencing farmers' attitudes ($\chi2 = 0.049$, $p = 0.004$). Older farmers had more positive attitudes ($\beta = 0.348$, $p < 0.001$) and were influenced by subjective norms, while younger farmers had stronger PBC ($\beta = 0.359$, $p < 0.001$). Already older farmers are more concerned about their own and livestock's health and potential crop losses than younger farmers; therefore, they have a positive attitude toward improving waste management facilities. Older farmers have a larger network. People ask them for their opinions on issues, and they often act as opinion leaders in the community; therefore, older age influences social norms.

Education significantly influenced farmers' attitudes ($\chi2 = 0.279$, $p = 0.039$). Interestingly, lower education-level farmers had more positive attitudes toward improving waste facilities. Gebrezgabher et al. (2015) came to similar conclusions in their work with 111 Dutch dairy farmers, finding that lower levels of education increased farmers' interest in adopting fertilizer separation technologies. This result is also consistent with the finding that farmers with 16 or more years of experience have a positive attitude. This explains that farmers with low education rely on their experience and learn lessons from past problems with waste ($\chi2 = 6.165$; $p = 0.013$). Demirtas (2017) found a statistically significant relationship between farming experience and

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

olive grove size in his study on olive farmers' participation in agricultural extension programs ($p < 0.001$). Bagheri et al. (2016) and Abdollahzadeh et al. (2015) confirmed the effect of the experience variable on the adoption of IPM.

Experience acts like education; more experience positively impacts farmers' behavior (Arunrat et al., 2017; Taqipour et al., 2015). It promotes constructive behavior in situations where the participant has a low level of education. Our research found that farmers with a low level of education but experience of 16 years or more have a positive intention to develop waste facilities.

Family size ($\chi^2 = 5.893$, $p = 0.015$) and the number of paid farm employees ($\chi^2 = 4.209$, $p = 0.004$) are statistically significantly related to SN. In a sense, the number of family members is inversely correlated with hiring paid labor on the farm. A larger family means more workers and less work pressure, especially for smaller farms. Family members feel much more social pressure to help around the farm. Farms typically hire paid labor when family labor cannot keep up with the workload or professional services are needed. Thus, the community pressures large farms to hire the necessary workers. In He et al.'s (2015) study of farmers' willingness to reuse agricultural waste, family labor was significant at the 1% statistical level in the proposed two models.

Farm ownership significantly impacts on-farm waste management ($\chi2 = 3.967$, $p < 0.001$). Farmers who are owners can pass on their farms to the next generations. Therefore, they are more likely to strive to protect the land by improving facilities that can help maintain waste management productivity (Arunrat et al., 2017).

Farm (cattle) size has a statistically significant effect ($\chi2 = 7.001$, $p = 0.021$) on farmer attitudes. Larger farms ($\beta = 0.23$, $p < 0.001$) were more likely to have a positive attitude toward improving their waste facilities than smaller farms ($\beta = 0.385$, $p < 0.001$). It is undeniable that large farms produce and must deal with a large amount of waste, so this result is consistent with previous research. Larger farms are more concerned about the adverse effects of manure accumulation. (Battel, 2006). Farmers have a more positive attitude toward utilizing waste more effectively — investment size discourages small farmers due to resource constraints. (Martinez-Garcia et al., 2013). The study also showed that cattle size and farm ownership had a statistically significant and positive effect on farmers' attitudes toward improving waste management facilities. However, there was no effect on PBC and SN. Larger livestock owners have more positive attitudes because livestock management requires a substantial fixed investment.

Income from livestock ($\chi^2 = 4.769$, $p = 0.029$) and other sources ($\chi^2 = 4.919$, $p = 0.027$) has shown a statistically significant effect on attitude. Farmers with higher farm income ($\beta = 0.443$, $p < 0.001$) but no off-farm income ($\beta = 0.376$, $p < 0.001$) have more positive and significant attitudes toward improving waste management facilities. Gross farming and non-farm income showed a positive and significant relationship between the factors affecting farmers' satisfaction with agricultural publishing services (Elias et al., 2015). Average monthly household income significantly influenced farmers' attitudes toward compost production in the Wadi al-Far'a Watershed in Palestine (Al-Madbouh et al., 2019).

Livestock farmers who derive higher income solely from livestock had more positive attitudes toward improving waste storage facilities. High livestock income gives farmers more security against the pressure to achieve short-term results (Jiang et al., 2018). They will focus on investments that produce long-term results regarding their

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

immediate environment and environmental sustainability. Non-farm income may include an annuity, real estate, or a land lease. Farmers may also engage in off-farm/part-time activities. An additional source of income can alleviate farmers' concerns and give them more security to invest in waste storage facilities. However, farmers who draw their salary elsewhere may be less willing to improve their waste facilities (Martinez-Garcia et al., 2013). Waste disposal is a labor-intensive activity. Participation in the off-farm position means farmers spend less time on their farms (Läpple, 2012).

In summary, farmers' attitudes in large areas were lower than average in education, relied solely on farm income significantly, and positively influenced the intention to improve farm waste facilities. Higher-educated farmers had larger families and employed more paid labor; on the other hand, subjective norms were the significant determinants. Consequently, these findings can be used to validate the fourth research question (H4).

Conclusions

The present study sought to predict farmers' intention to improve on-farm waste storage and disposal by applying TPB to promote environmental sustainability in the Turkish context. The study also aimed to consider the contribution of different farmer and farm characteristics to predicting intention in the sample studied. The results of the analysis of SEM proved the effectiveness of using the TPB model to explain farmers' intentions to engage in environmental sustainability practices in the context of Turkey, a country with a developing agriculture-based industry. The results also confirmed the viability of the proposed TPB model to predict farmers' intentions. It can be concluded that attitude strongly indicates farmers' intentions in Turkey to engage in on-farm waste management practices. However, it should be noted that SN and PBC equally influence intention and, thus, behavior. In rural areas, there is still a close interaction between the two sectors.

This research was conducted in Turkey; however, the results of this study will provide valuable insights to other researchers. Turkish livestock farmers are comparable in size and ownership to other farmers worldwide, especially in developing countries, and face similar economic and political problems.

Based on the findings, the following recommendations were made. Turkey has no specific legislation for agricultural waste. Agricultural waste must be regulated and monitored by law by the Ministry of Agriculture (MoA).

Due to the rapid expansion of the cities into the countryside and the many villages that remained within the new municipal boundaries, the municipalities began to participate in agriculture actively. They began to provide various subsidies to farmers and assist them in the disposal of agricultural waste. Municipalities should also provide low-cost materials for constructing, rehabilitating, and expanding waste storage and disposal facilities. They should provide free advisory services during the design and construction, simplify licensing procedures, and even provide non-recourse or low-interest loans.

Farmers receive agricultural extension services for production, sales, and technology. However, the extension services do not cover waste-related topics. These topics should be included in the extension services. They should provide adequate services at waste management facilities' planning, construction, and licensing stages. Farmers should be

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

encouraged to improve their waste storage and processing facilities by obtaining non-recourse or soft loans.

Current livestock insurance only covers the loss of livestock, and agricultural disaster insurance only covers the loss of crops. Animal shelters, waste processing, storage, and disposal facilities should also be included in the scope of insurance, and the state should guarantee the investments and improvements farmers make to these facilities.

Lastly, since farmers have lower levels of education and limited financial resources to initiate sustainable activities, policy-makers, local governments, and farmers' organizations, including cooperatives that impact farmers' behavior, should provide comprehensive training programs and raise environmental awareness. Farmers should be encouraged to participate in these courses. Mass media such as radio, television, and digital media, as well as their institutional resources, should be used to reach the broadest possible audience.

REFERENCES

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

[2] Ajzen, I. (2012): The Theory of Planned Behavior. – In: Van Lange, P. A. M., Kruglanski, A. W., Higgins, E. T. (eds.) Handbook of Theories of Social Psychology. Volume 1. Sage Publications, London. https://doi.org/10.4135/9781446249215.n22.

[3] Ajzen, I., Fishbein, M. (2005): The influence of attitudes on behavior. – In: Albarracín, D., Johnson, B. T., Zanna, M. P. (eds.) The Handbook of Attitudes. Lawrence Erlbaum Associates Publishers, Mahwah, NJ.

[4] Alpan, O., Aksoy, A. R. (2015): Livestock farming and breeding. 7th Edition. – Istanbul, Turkey.

[5] Anderson, J. C., Gerbing, D. W. (1988): Structural equation modeling in practice: a review and recommended two-step approach. – Psychological Bulletin 103(3): 411-423.

[6] Arunrat, N., Wang, C., Pumijumnong, N., Sereenonchai, S., Cai, W. (2017): Farmers' intention and decision to adapt to climate change: a case study in the Yom and Nan basins, Phichit province of Thailand. – Journal of Cleaner Production 143: 672-685. http://dx.doi.org/10.1016%2Fj.jclepro.2016.12.058.

[7] Bakir, G., Kibar, M. (2020): Determining properties of barns of dairy cattle farms in Mus province. – Kahramanmaras Sutcu Imam University Journal of Agriculture and Nature 23(4): 1085-1095. https://doi.org/10.18016/ksutarimdoga.vi.687242.

[8] Battel, R. D. (2006): Farmer willingness to enter into manure exchange agreements: differences based on age and farm size. – Journal of Extension 44(3): 14.

[9] Borges, J. A. R., Tauera, L. W., Oude Lansink, AGJM (2016): Using the theory of planned behavior to identify key beliefs underlying Brazilian cattle farmers' intention to use improved natural grassland: a MIMIC modelling approach. – Land Use Policy 55: 193-203. http://dx.doi.org/10.1016/j.landusepol.2016.04.004.

[10] Boyaci, S., Akyuz, A., Kukurtcu, M. (2011): Environmental pollutions caused by manure in animal barns and potential solutions. – Research Journal of Agricultural Sciences 4(1): 49-55.

[11] Cayir, M., Atilgan, A. (2012): Examinations of manure condition from cattle barns related to water resources. – Suleyman Demirel University Journal of Faculty of Agriculture 7(2): 1-9.

[12] Chaudhary, A. K., Warner, L. A., Lamm, A. J., Isreal, G., Rumble, J. N., Cantrell, R. (2017): Using the theory of planned behavior to encourage water conservation among extension clients. – Journal of Agricultural Education 58(3): 185-202. https://doi.org/10.5032/jae.2017.03185.

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

[13] Chin, W. W. (1998): Commentary: issues and opinions on structural equation modeling. – MIS Quarterly 22(1): 7-16.
[14] Despotovic, J., Rodic, V., Caracciolo, F. (2019): Factors affecting farmers' adoption of integrated pest management in Serbia: an application of the theory of planned behavior. – Journal of Cleaner Production 228: 1196-1205. https://doi.org/10.1016/J.JCLEPRO.2019.04.149.
[15] Faisal, M., Chunping, X., Akhtar, S., Raza, M. H., Khan, M. T. I., Ajmal, M. A. (2020): Modeling smallholder livestock herders' intentions to adopt climate smart practices: an extended theory of planned behavior. – Environmental Science and Pollution Research 27(31): 39105-39122. https://doi.org/10.1007/s11356-020-09652-w.
[16] Fielding, K. S., McDonald, R., Louis, W. R. (2008): Theory of planned behaviour, identity and intentions to engage in environmental activism. – Journal of Environmental Psychology 28(4): 318-326. https://doi.org/10.1016/j.jenvp.2008.03.003.
[17] Fornell, C., Larcker, D. F. (1981): Evaluating structural equation models with unobservable variables and measurement error. – Journal of Marketing Research 18(1): 39-50. https://doi.org/10.2307/3151312.
[18] Francis, J., Eccles, M. P., Johnston, M., Walker, A. E., Grimshaw, J. M., Foy, R., Kaner, E. F. S., Smith, L., Bonetti, D. (2004): Constructing questionnaires based on the theory of planned behaviour: a manual for health services researchers. – Centre for Health Services Research, University of Newcastle upon Tyne, Newcastle upon Tyne, UK.
[19] Gebrezgabher, S. A., Meuwissen, M. P. M., Kruseman, G., Lakner, D., Alfons, G. J. M., Oude Lansink, A. G. J. M. (2015): Factors influencing adoption of manure separation technology in the Netherlands. – Journal of Environmental Management 150: 1-8. http://dx.doi.org/10.1016/j.jenvman.2014.10.029.
[20] Govindharaj, G. P. P., Gowda, B., Sendhil, R., Adak, T., Raghu, S., Patil, N., Mahendiran, A., Rath, P. C., Kumar, G. A. K., Damalas, C. A. (2021): Determinants of rice farmers' intention to use pesticides in eastern India: application of an extended version of the planned behavior theory. – Sustainable Production and Consumption 26: 814-823. https://doi.org/10.1016/j.spc.2020.12.036.
[21] Guler, O., Aydin, R., Diler, A., Yanar, M., Kocyigit, R., Marasli, A. (2017): A research on housing characteristics of cattle enterprises. The case of Erzurum, Narman. – Yuzuncu Yil University Journal of Agricultural Sciences 27(3): 396-405. https://doi.org/10.29133/yyutbd.315389.
[22] Gurbuz, B. I., Ozkan, G. (2019): What's going on at the universities? How much has the research revealed university students' attitudes towards the environment? A case study of Bursa, Turkey. – Applied Ecology Environmental Research 17(2): 5109-5138. http://dx.doi.org/10.15666/aeer/1702_51095138.
[23] Gurbuz, B. I., Ozkan, G. (2021): A holistic approach in explaining farmers' intentional behaviour on manure waste utilisation. – New Medit 20(4). https://doi.org/10.30682/nm2104g.
[24] Guven, O. (2021): Structural problems of cattle farms in Ardahan and Kars Provinces. – Adnan Menderes University Faculty of Agriculture Journal of Agricultural Sciences 18(2): 149-155. https://doi.org/10.25308/aduziraat.788995.
[25] Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E. (2010): Multivariate Data Analysis. Seventh Ed. – Prentice Hall, Upper Saddle River, New Jersey.
[26] Jiang, L., Zhang, J., Wang, H. H., Zhang, J., He, K. (2018): The impact of psychological factors on farmers' intentions to reuse agricultural biomass waste for carbon emission abatement. – Journal of Cleaner Production 189: 797-804. https://doi.org/10.1016/j.jclepro.2018.04.040.
[27] KKB (2022): Agricultural Landscape Field Research. – Credit Registration Office. https://www.kkb.com.tr/Resources/ContentFile/KKB_2022_TARIMSAL_GORUNUM_SAHA_ARASTIRMA_KASIM_2022.pdf.

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

[28] Läpple, D. (2012): Comparing attitudes and characteristics of organic, former organic and conventional farmers: evidence from Ireland.. – Renewable Agriculture and Food Systems 28(4): 329-337. https://doi.org/10.1017/S1742170512000294.
[29] Mahdavi, T. (2021): Application of the 'theory of planned behavior to understand farmers' intentions to accept water policy options using structural equation modeling. – Water Supply 21(6): 2720-2734. https://doi.org/10.2166/ws.2021.138.
[30] Maleksaeidi, H., Keshavarz, M. (2019): What influences farmers' intentions to conserve on-farm biodiversity? An application of the theory of planned behavior in Fars province, Iran. – Global Ecology and Conservation 20: e00698. https://doi.org/10.1016/j.gecco.2019.e00698.
[31] Martinez-Garcia, C. G., Dorward, P., Rehman, T. (2013): Factors influencing adoption of improved grassland management by small-scale dairy farmers in central Mexico and the implications for future research on smallholder adoption in developing countries. – Livestock Science 152: 228-238. http://dx.doi.org/10.1016/j.livsci.2012.10.007.
[32] Meijer, S. S., Catacutan, D., Sileshi, G. W., Nieuwenhuis, M. (2015): Tree planting by smallholder farmers in Malawi: using the Theory of Planned Behaviour to examine the relationship between attitudes and behaviour. – Journal of Environmental Psychology 43: 1-12. http://dx.doi.org/10.1016/j.jenvp.2015.05.008.
[33] Mundan, D., Atalar, B., Meral, B. A., Yakisan, M. M. (2018): A research on the determination of the structural and technical characteristics of modern dairy cattle enterprises. – Atatürk University Journal of Veterinary Sciences 13(2): 201-210. https://doi.org/10.17094/ataunivbd.331282.
[34] Noremark, M., Sternberg Lewerin, S., Ernholm, L., Frössling, J. (2016): Swedish farmers' opinions about biosecurity and their intention to make professionals use clean protective clothing when entering the stable. – Frontiers in Veterinary Science 3: 46. https://doi.org/10.3389/fvets.2016.00046.
[35] Nunnally, J. C. (1978): Psychometric Theory. 2nd Ed. – McGraw-Hill, New York.
[36] Ozocak, M. (2019): Management of fertilizer waste systems in animal production structures and vermiculture. – Bayburt University Journal of Science 2(2): 316-324.
[37] Peypazar, Z. B., Kilic, I. (2021): Evaluation of waste management systems in dairy cattle farms in terms of environmental pollution: Kutahya case study. – Uludağ University Journal of The Faculty of Engineering 26(1): 15-28. https://doi.org/10.17482/uumfd.811129.
[38] Rezaei, R., Safa, L., Damalas, C. A., Ganjkhanloo, M. M. (2019): Drivers of farmers' intention to use integrated pest management: integrating theory of planned behavior and norm activation model. – Journal of Environmental Management 236: 328-339. https://doi.org/10.1016/j.jenvman.2019.01.097.
[39] Scheaffer, R. L., Mendenhall, W., Lyman, O. (1979): Elementary Survey Sampling. 2nd Ed. – Duxbury, Boston, MA.
[40] Senger, I., Borges, J. A. R., Machado, J. A. D. (2017): Using the theory of planned behavior to understand the intention of small farmers in diversifying their agricultural production. – Journal of Rural Studies 49: 32-40. http://dx.doi.org/10.1016/j.jrurstud.2016.10.006.
[41] Sirin, U., Kocaman, B. (2016): Optimum design of dairy cattle farm buildings in Erzurum and its surroundings. – Journal of Agricultural Faculty of Gaziosmanpasa University 33(3): 28-38. https://doi.org/10.13002/jafag1003.
[42] Sukhmani, G. M. (2017): Using theory of planned behavior in investigating agricultural waste management: survey evidence from Northern India. – Vilakshan: The XIMB Journal of Management 14(2): 39-52.
[43] Tabachnick, B. G., Fidell, L. S. (2007): Using Multivariate Statistics. – Pearson Education Inc, Boston.

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219

[44] Taqipour, M., Abbasi, E., Chizari, M. (2015): Farmers' behavior toward membership in water user associations (WUAs) in Iran: applying the Theory of Planned Behaviour. – European Online Journal of Natural and Social Sciences 4(2): 336-350.
[45] Tarmakbir. (2023): Turkey agricultural machinery sector. Sector report. – Turkish Agricultural Machinery Manufacturers Association. http://www.tarmakbir.org/haberler/tarmakbirsekrap.pdf. Accessed 13 July 2023.
[46] Turkstat (2018): Agricultural enterprise structure survey, 2016. – Turkish Statistical Institute. https://www.resmiistatistik.gov.tr/detail/subject/tarimsal-isletme-yapi-istatistikleri/. Accessed 13 July 2023.
[47] Turkstat (2023): Address-based population registration system results. – Turkish Statistical Institute. https://data.tuik.gov.tr/Bulten/Index?p=Adrese-Dayali-Nufus-Kayit-Sistemi-Sonuclari-2020-37210. Accessed 13 July 2023.
[48] Unvar, S. (2023): Regional analysis of electricity energy produced from animal manure sourced biogas in Turkey. – Yuzuncu Yil University Journal of the Institute of Natural and Applied Sciences 28(1): 131-139.
[49] Varol, H., Atilgan, A. (2017): Management of waste generated in livestock enterprises and possible environmental effects: an example of Afyonkarahisar. – Academia Journal of Engineering and Applied Sciences 1(3): 211-221.
[50] Yazdanpanah, M., Hayati, D., Hochrainer-Stigler, S., Zamani, G. H. (2014): Understanding farmers' intention and behavior regarding water conservation in the Middle East and North Africa: a case study in Iran. – Journal of Environmental Psychology 135: 63-72. http://dx.doi.org/10.1016/j.jenvman.2014.01.016.
[51] Yzer, M. (2012): Perceived behavioral control in reasoned action theory: a dual-aspect interpretation. – The Annals of the American Academy of Political and Social Science 640(1): 101-117. https://doi.org/10.1177/0002716211423500.

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2106_52015219