

Analyzing Iranian Farmers' Behavioral Intention towards Acceptance of Drip Irrigation Using Extended Technology Acceptance Model

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ABSTRACT

The present study aimed to analyze sugar beet farmers' intention towards the acceptance of drip irrigation based on an extended version of Technology Acceptance Model (TAM). The main objectives of this study were introduction of the existing acceptance behavior models, comparison of these theories with a critical point of view, presentation of a theoretical framework based on TAM, and testing the possible relationships among variables. This descriptive-correlational research was conducted through a cross-sectional survey. The statistical population of the study was sugar beet growers of Miandoab District, Iran, of which 346 farmers were selected as the sample of the study using a multi-stage stratified random sampling method (N= 3326). The research instrument was a structured questionnaire, whose face, convergent, and discriminant validity were confirmed. Cronbach's alpha and composite reliability coefficients were employed to examine the reliability of research tool ($0.74 < \alpha < 0.93$). The results revealed that the variables of attitude, perceived ease of use, and perceived usefulness have significant positive effects on behavioral intention towards accepting drip irrigation technology. Innovation features also have an indirect effect on behavioral intention. Furthermore, the results demonstrated that independent variables of extended version of TAM could account for 59.3% of variance of behavioral intention towards drip irrigation acceptance. The significant effect of attitude towards acceptance of drip irrigation in explaining farmers' intention towards acceptance of drip irrigation technologies implies that reinforcing farmers' attitudes will increase the likelihood of activating behavioral intention towards these new irrigation methods. In general, the results of this study contribute to the development of more integrated and comprehensive models in the field of farmers' acceptance behaviors. It also provides practitioners and policy makers of agriculture and water sectors with some useful insights regarding determinants and strategies of behavioral changes.

Keywords: Behavioral intention, Descriptive-correlational research, Innovation diffusion theory.

INTRODUCTION

Water is a fundamental and strategic resource for development. However, human activities and climate changes have recently increased pressure on global water resources (Chen *et al.*, 2017). World population will face with an enormous challenge over the next 40 years to produce almost 50% more

food up to 2030 and double production by 2050 (OECD, 2017). Therefore, water scarcity crises are serious threats to sustainable development, environment's safety, and human health and welfare. The importance of paying attention to the consequences of water scarcity is more perceptible in countries such as Iran, which is almost dry and has low annual rainfall

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(Valizadeh *et al.*, 2018). Due to the water limitations of Iran, only 7.8 million hectares of agricultural lands are being cultivated, which accounts for about 90% of the country's food products (Valizadeh *et al.*, 2018). Furthermore, agricultural sector has the highest rate of water consumption among the industrial, agricultural, and domestic sectors (Ministry of Agriculture-Jahad, 2018).

Agriculture has a major contribution to Iran's economic growth. Low rainfall rates and their uneven distribution have turned water into the most important bottleneck for the development of this sector. It is such that total irrigation efficiency in Iran is 33 to 37%, which is less than the average of developing countries (45%) and developed countries (60%) (Salem, 2017). Therefore, paying attention to the proper management of water resources is inevitable (Valizadeh *et al.*, 2019). The first step in this direction is to change the behavior of water users/farmers. One of the manifestations of behavioral changes in rural and agricultural communities to improve their water consumption behaviors is to focus on the acceptance of optimal and water-saving innovations (Balali *et al.*, 2016). Studies show that irrigation of farms and agricultural lands in most parts of Iran is carried out using traditional methods with a low irrigation efficiency. Compared to traditional irrigation systems, the effectiveness of pressurized irrigation systems is more than 70% (Salem, 2017). However, investigations (see Salem, 2017) show that only 10% of Iranian farmers apply pressurized irrigation systems in their agricultural lands. An interesting point is that the use of water-saving optimization systems is much lower in some parts of the country, such as West Azerbaijan province (Statistical Center of Iran, 2017). For example, Miandoab City is one of the most fertile agricultural areas in this province, which uses a significant amount of surface and underground water resources (Agricultural Jihad Organization of West Azerbaijan Province, 2018). This district is one of the fertile plains in the

northwest of the country and its main agricultural products include sugar beet, apples, and maize. The area under the cultivation of sugar beet in this plain is about 4,494 hectares, which accounts for about 15% of the total area under cultivation in Iran (Agricultural Jihad Organization of West Azerbaijan Province, 2018). However, investigations show that most farmers do not use modern irrigation practices, such as drip irrigation, for its production (Agricultural Jihad Organization of West Azerbaijan Province, 2018). This factor has also led to more water consumption in the agricultural sector of this region.

Considering that identification and analysis of factors affecting the acceptance of water-related innovations can have a significant impact on the productivity and efficiency of water consumption, the main purpose of this research was to analyze intention towards the acceptance of drip irrigation among sugar beet growers in Miandoab District. Thus, the main theme of this paper is to develop a suitable theoretical framework for sugar beet farmers' intention towards the acceptance of drip irrigation and analyze their intention using a cross-sectional survey in the research site.

Technology acceptance is considered as a very important issue in the field of agriculture. In recent decades, many theories and models have been used to accurately and systematically identify factors affecting innovation adoption (Rajaei *et al.*, 2019). Technology Acceptance Model (TAM) (Davis, 1989) and Innovations' Diffusion Theory (IDT) (Rogers, 1983) have been the most common and most widely used models in the field of innovation acceptance, which have been developed from Reasoned Action Theory (RAT) and Theory of Planned Behavior (TPB). Many studies have employed these theories in different fields (see AliSalehAl-Ajam, 2013; Mutahar *et al.*, 2017; Rezaei-Moghaddam and Salehi, 2010). Of course, it should be kept in mind that many other theories and models have also been used for acceptance behaviors. For example, RAT (Ajzen and Fishbein, 1980),

TPB (Ajzen, 1991), Norm Activation Theory (NAT) (Schwartz, 1970), and Value-Belief-Norm Theory (VBNT) (Stern, 2000) are among the most commonly used theories in the literature (Kim *et al.*, 2016; Yousafzai *et al.*, 2010). TRA specifies that behavioral intention is a function of two determinants of a personal factor, termed attitude toward behavior, and a person's perception of social pressures, termed subjective norm.

NAT and its extended version called VBNT have also been used in the field of acceptance of different theories (see De Groot and Steg, 2010; Yousafzai *et al.*, 2010). These two theories consider the technology acceptance behavior as a moral situation. The fundamental assumptions of these theories are completely explained in Valizadeh *et al.* (2018). Although NAT and VBNT have been used for acceptance behaviors, researchers are not usually very interested in using these theories in their work. One of the most important reasons for this unwillingness is that they make the chain of behavior activation very long. However, RAT and TPB form the basis for the emergence of TAM and IDT because of their short chain for behavior. Apart from the story, it should be pointed that theories of NAT, VBNT, RAT, and TPB mainly originated from environmentalism and have been usually applied for analyzing environmental and pro-environmental behaviors (Valizadeh *et al.*, 2018). However, since many of these behaviors do not necessarily imply acceptance of an innovation and technology, researchers try to use TAM and IDT in acceptance studies.

TAM has evolved based on theories of social psychology, such as RAT (Ajzen and Fishbein, 1980) and Theory of Planned Behavior (Ajzen, 1991). This template sets a ground for understanding how external factors (innovative features) can affect belief, attitude, and behavioral intention (Tran and Cheng, 2017). Based on this model, users' decisions about the adoption of innovations are based on two rational assessments towards expected outcomes. The first assessment refers to perceived ease

of use, which is related to one's perception about toughness or ease of application of an innovation (AliSalehAl-Ajam, 2013; Tran and Cheng, 2017). The second assessment method reflects perceived usefulness and demonstrates individuals' belief in the fact that "the use of specific innovations can improve their performance" (Tran and Cheng, 2017).

According to the assumptions of TAM, actual use of an innovation is (in-)directly related to the user's intention, attitude, perceived usefulness of innovation, and its perceived ease of use. Furthermore, TAM suggests that external factors (such as features of technology) affect intention and actual use (behavior) through mediating variables, such as perceived usefulness, perceived ease of use, and attitude (Davis, 1989; Lee *et al.*, 2011). Several studies (Sharifzadeh *et al.*, 2017; Abdollahzadeh *et al.*, 2016; Lee *et al.*, 2011) have confirmed the capability and credibility of Technology Acceptance Model by measuring and determining factors influencing technology acceptance. However, many researchers have suggested that this model should be developed by adding new variables from other theories like Innovations' Diffusion Theory (IDT) (Lin, 2007).

IDT was developed by Rogers (Rogers, 1983). In the process of innovation diffusion, innovation is the successful introduction of a new technology or integration of existing technologies to make an effective change in target group or users (Li Hua *et al.*, 2011). Contrary to its name, there is no need for an innovation to be a very new idea. It means that if an idea/method/tool is new from the perspective of a target group, it can be considered as an innovation (Rogers, 1983).

In IDT, five determinants for innovativeness including relative advantage, compatibility, complexity, testability, and visibility affect adoption behavior. Relative advantage is the extent to which an innovation/technology is perceived to be better than current/prior innovations/technologies (Rivera Green,



2007; AliSalehAl-Ajam, 2013). Visibility is the extent to which the results of a technology is observable for others (Mutahar *et al.*, 2017), while compatibility is the extent to which a technology is adaptable with present needs, values, and experiences of adopters (Rivera Green, 2007; Mutahar *et al.*, 2017). Testability is the extent to which a technology is applicable prior to its full adoption (Rivera Green, 2007; Mutahar *et al.*, 2017), and complexity refers to the extent to which a technology is believed to be tough to apply or learn (Tran and Cheng, 2017). Rogers believes that innovation features play a prominent role in diffusion process of innovation. As such, they are suitable criteria for anticipating the adoption of innovation (Rogers, 1983).

IDT and TAM (which are originally based on the TPB and RAT) have been used in a variety of disciplines such as management (Rajaei *et al.*, 2019), psychology (De Groot and Steg, 2010), marketing (Kim *et al.*, 2016), sociology (Rajaei *et al.*, 2019), communication, and agriculture (Rezaei-Moghaddam and Salehi, 2010). Nevertheless, there are still lots of links between these two models that have not been explored in previous studies. However, integration of these two theories can provide a realistic picture of acceptance of technology/innovation (Tran and Cheng, 2017). Reviewing the literature shows that few studies (Lee *et al.*, 2011; AliSalehAl-Ajam, 2013; Tran and Cheng, 2017) have linked IDT with TAM, TRA and so on to investigate the technology/innovation acceptance behavior of individuals. However, there is evidence that confirms the point that "adding innovation feature to TAM increases the explained variance of independent variable" (Yousafzai *et al.*, 2010; Rezaei-Moghaddam and Salehi, 2010).

Accordingly, we added the features of technology (as external variables) to the TAM in order to increase the validity and efficiency of study. In other words, the absence of some key variables, such as variables related to innovation features, in

the model will cause it to be incomplete (Green, 2005). In addition, their absence will reduce the amount of explanation of the dependent variable that is one of the main criteria for validating behavioral models (Rezaei-Moghaddam and Salehi, 2010). The variables of perceived ease of use and complexity have a close relationship and most studies consider them as the same variables (Green, 2005). However, it must be mentioned that perceived ease of use refers to the degree to which a person "feels and perceives" using a particular system free of effort (Davis, 1989). However, complexity refers to the degree to which a person "believes" an innovation is complicated to use (Rogers, 1983). In other words, despite the close relationship between these two variables, there are conceptual and causal differences between them. For example, perceived ease of use precedes the complexity (Malekmohammadi, 2011). In this regard, these two variables were considered as two different variables in this study. About the differences of the variables of perceived usefulness and relative advantages, it should be noted that the aim of perceived usefulness was to understand the perception of farmers on drip irrigation. In other words, it demonstrates the benefits of using specific innovations in improving their performance (Tran and Cheng, 2017). However, the variable of relative advantages focuses on the "comparison" of drip irrigation and traditional irrigation system. In other words, since the usefulness of one method may not necessarily lead to its preference over the previous one (Malekmohammadi, 2011), these variables were considered as two distinctive constructs.

Based on TAM, the variables of perceived usefulness, perceived ease of use, and attitude were considered as the direct predictors of sugar beet growers' intention towards acceptance of drip irrigation (Figure 1). Of course, it is worth mentioning that perceived usefulness and perceived ease of use have indirect effects on behavioral intention through the mediating role of attitude

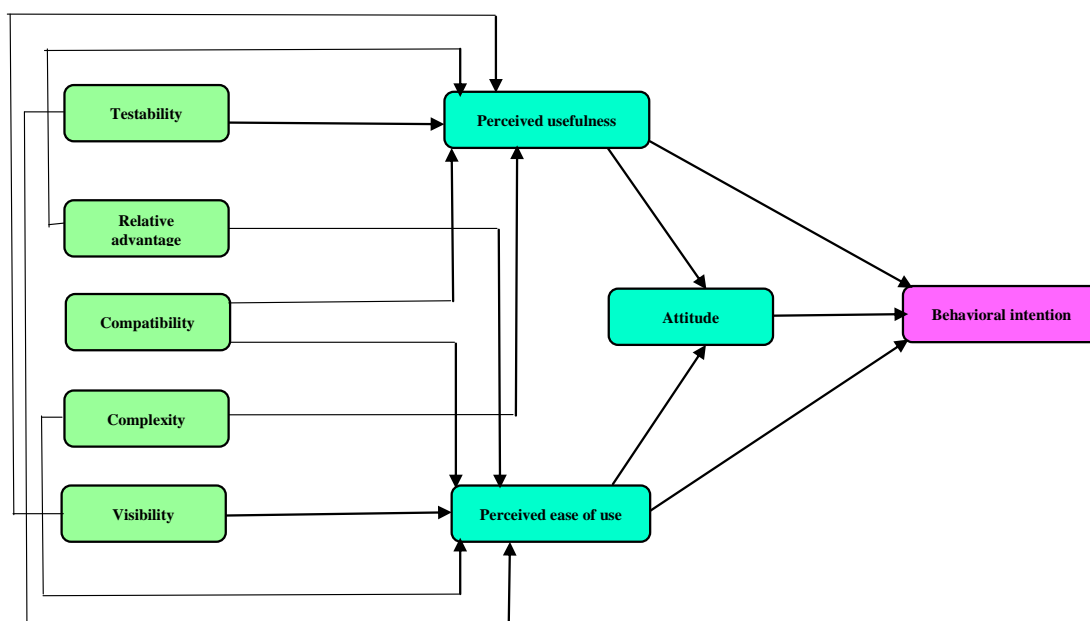


Figure 1. Theoretical framework of the study.

towards drip irrigation. Furthermore, according to Mutahar *et al.* (2017), innovation features (testability, relative advantages, compatibility, complexity, and visibility) are indirect determinants of behavioral intention. Perceived usefulness and perceived ease of use are mediators of the effects of innovation features on attitude and behavioral intention towards the acceptance of drip irrigation. The main reason for considering perceived ease of use and perceived usefulness as the mediator in the theoretical framework is that Davis (1989) emphasized that these variables should have direct relationship with intention. Indeed, they are fundamental in understanding core working of TAM. Moreover, Rezaei-Moghaddam and Salehi (2010) claim that without perceived ease of use and perceived usefulness there will be no intention for acceptance. The main value of this research is that it gives clear and understandable insights about the process, stages, and mechanisms of forming acceptance intention. This was carried out by theoretical and systematic analyses of the strengths and weaknesses of different existing theories and, then, development of a framework for acceptance intention.

Furthermore, it must be mentioned that this study was the first study in the field of acceptance of drip irrigation among sugar beet growers. Also, the topic of this research was one of the most significant research priorities of Agricultural Jihad Organization, Department of Environment, and Ministry of Energy. Therefore, this study is completely problem-oriented and its results can be very insightful for practitioners, policy-makers and decision-makers of these organizations.

MATERIALS AND METHODS

This research is an applied and cross-sectional study. The statistical population of this study was sugar beet growers of Miandoab District in West Azerbaijan Province, Iran (N= 3326). Based on the Krejcie and Morgan (1970) sampling table, the sample size was estimated to be 346 farmers. A multistage stratified random sampling method was used for sample selection. For this purpose, the study area was first divided into 11 sub-counties. Two villages were randomly selected from each sub-county (totally 22 villages were selected). Finally, the samples were



randomly selected from sugar beet growers of the villages and were asked to answer the survey questions. The research instrument was a questionnaire, whose face validity was confirmed by a panel of experts. The group consisted of academic specialists in the field of agricultural sociology and water studies and practitioners of Agricultural Jihad Organization of West Azerbaijan Province. Cronbach's alpha coefficients were also used to determine the reliability of the study tool. For this purpose, a pilot group, including 30 farmers, was selected. Table 1 shows the main variables of the study and Cronbach's alpha coefficients for different parts of the research tool. Convergent validity, discriminant validity, and composite reliability of the research instrument were also calculated and confirmed for different parts of the questionnaire (Table 2). After implementing the pilot study and making the necessary corrections in the research tool, the questionnaire was prepared for the main survey stage. For example, some of the terms that were not understandable to farmers were removed/replaced. Also, items whose elimination made a significant contribution to the Cronbach's alpha coefficients were excluded from the main questionnaire.

A five-point Likert scale was employed for measuring all variables existing in the Figure 1 (1: Totally disagree, 2: Disagree, 3: I have no idea, 4: Agree, and 5: Totally agree). In addition, it should be noted that the items of the variables and their references are presented in Table 1. Other variables studied in the present research were gender, age, educational level, and agricultural work experience.

Required data for the research were gathered using face-to-face interviews with sugar beet growers. At the end of survey, 344 questionnaires were collected. Out of these, 2 questionnaires were dropped out due to many missing data. These questionnaires were excluded, because respondents were free to answer (or refuse to answer) the questionnaire or questions during face-to-face interviews. Therefore, some of them did

not answer some questions asked in the questionnaire. Finally, 342 questionnaires were analyzed. SPSS_{win22} software was used to analyze the data.

RESULTS AND DISCUSSION

Descriptive analysis of the data for the variable of age indicated the average of approximately 44 years for respondents (SD=13.23). Investigating gender of farmers showed that about 94% (n= 312) were male and 6% (n= 20) were female. In addition, the number of years for formal education revealed that the average number of years of education for respondents was about 8 years (SD= 5.26). However, division of respondents based on level of education also demonstrated that most of them had low education ($10 > X_i$). The average of farmers' agricultural work experience was estimated to be about 21 years.

The results of correlation analysis between variables (Table 3) indicated that attitude towards drip irrigation ($r= 0.672$, $P < 0.01$), perceived usefulness ($r= 0.543$, $P < 0.01$), and perceived ease of use ($r= 0.466$, $P < 0.01$) had significant positive correlation with behavioral intention towards the acceptance of drip irrigation. These findings are consistent with the findings of AliSalehAl-Ajam (2013). Besides, the correlation between compatibility with perceived usefulness ($r= 0.497$, $P < 0.01$) and attitude towards drip irrigation ($r= 0.629$, $P < 0.01$) was significant.

The variables of relative advantage, compatibility, complexity, visibility, and testability positively and significantly correlated with perceived usefulness, perceived ease of use, attitude, and behavioral intention towards the acceptance of drip irrigation. Similar results can be seen among the findings of studies conducted by AliSalehAl-Ajam (2013), Tran and Cheng (2017) and Rezaei-Moghaddam and Salehi (2010). In addition, visibility had a positive and significant correlation with the variables of perceived usefulness and perceived ease

Table 1. The items used to measure variables and Cronbach's alpha coefficients.

	Reference number ^a
Behavioral intention towards drip irrigation acceptance ($\alpha= 0.85$)	
1 I intend to recommend drip irrigation to others.	1
2 I plan to use a drip irrigation system if needed.	2
3 I intend to use a drip irrigation system forever.	3
4 I will use this method in the future.	3
5 I have to use drip irrigation for sugar beet cultivation in the near future.	4
Attitude towards drip irrigation ($\alpha= 0.74$)	
1 I think the development of drip irrigation is of great importance.	3
2 Using this method of irrigation can have positive effect on my farm's productivity.	3
3 By using this irrigation method, I will contribute to conservation of water resources.	3
4 Using this watering method, I can save more water.	4
5 I believe that it is essential to protect water using water-saving irrigation techniques like drip irrigation.	4
6 I like the idea of using drip irrigation.	2
7 Due to lack of water, the use of drip irrigation seems wise.	1
8 I think using drip irrigation is beneficial.	3
Perceived usefulness of drip irrigation ($\alpha= 0.91$)	
1 Using drip irrigation will definitely boost the performance of production.	5
2 By using a drip system, the amount of water I consume will be less.	5
3 Using drip irrigation will cause me to harvest more land.	3
4 The use of drip irrigation can help me save my time.	4
5 Using drip irrigation will improve the quality of my work.	3
Perceived ease of use of drip irrigation ($\alpha= 0.83$)	
1 It's easy for me to use a drip irrigation system.	3
2 Learning this system is easy.	4
3 Anyone can use this system.	2
4 Working with this system requires a lot of effort (invers).	1
Relative advantage ($\alpha= 0.78$)	
1 The initial cost of drip irrigation is higher than its added value.	5
2 The advantage of using drip irrigation is its profitability.	5
3 Using drip irrigation is one of the best ways to deal with water shortage.	3
Compatibility ($\alpha= 0.91$)	
1 Drip irrigation is more adapted with underwater conditions in the area.	6
2 Drip irrigation is compatible with my needs.	5
3 Drip irrigation is compatible with my cropping condition.	5
4 Drip irrigation is compatible with my experience in irrigation.	3
Complexity ($\alpha= 0.87$)	
1 I have no problem in using a drip irrigation system.	3
2 It's hard for me to know how to use the drip system.	5
3 I have no problem in understanding the information about the drip irrigation system.	6
Testability ($\alpha= 0.76$)	
1 I can try it before deciding on accepting drip irrigation.	3
2 I can do drip irrigation in a small part of my farm.	6
3 The ability to use drip irrigation is important in my decision-making.	6
Visibility ($\alpha= 0.93$)	
1 Positive effects of drip irrigation on economic condition can be seen on the land of others.	3
2 Positive effect of drip irrigation on reduction of required labor force is completely visible.	6
3 Positive effect of drip irrigation on the environment and water resources is completely visible.	6

^a 1= Valizadeh *et al.* (2019); 2= Tsai *et al.* (2014); 3= Self-developed; 4= Alambaigi and Ahangari (2016); 5= Valizadeh *et al.* (2018); 6= Golbaz and Karami-Dehkordi (2015).



Table 2. Convergent Validity (AVE), Discriminant Validity (DV), and Composite Reliability (CR) of research tool.

Variable	AVE	DV	CR
Behavioral intention towards drip irrigation acceptance	0.61		0.83
Attitude towards drip irrigation	0.58		0.73
Perceived usefulness of drip irrigation	0.72	0.19 < 0.58	0.90
Relative advantage	0.79		0.82
Compatibility	0.71		0.85
Complexity	0.63		0.82
Testability	0.67		0.71
Visibility	0.79		0.89
Cut-off values	AVE > 0.5	Variance extracted > Correlation square	CR > 0.7

Table 3. Correlation among the study variables.

	Behavioral intention towards drip irrigation acceptance	Attitude towards drip irrigation	Perceived usefulness of drip irrigation	Perceived ease of use of drip irrigation	Testability	Relative advantage	Compatibility	Complexity	Visibility
Behavioral intention towards drip irrigation acceptance	1								
Attitude towards drip irrigation	0.672**	1							
Perceived usefulness of drip irrigation	0.543**	0.505**	1						
Perceived ease of use of drip irrigation	0.466**	0.422**	0.445**	1					
Testability	0.466**	0.434**	0.389**	0.325**	1				
Relative advantage	0.547**	0.478**	0.372**	0.273**	0.280**	1			
Compatibility	0.621**	0.629**	0.497**	0.479**	0.421**	0.464**	1		
Complexity	0.175**	0.122*	0.231**	0.246**	0.097	0.184**	0.182**	1	
Visibility	0.038	0.014	0.177**	0.180**	0.099	0.068	0.003	0.017	1

of use. This result contradicts the findings of Rezaei-Moghaddam and Salehi (2010).

The results obtained from analyzing the effects of independent variables on dependent variables (Table 4) revealed that perceived ease of use ($\beta = 0.148$; $P < 0.001$), perceived usefulness ($\beta = 0.230$; $P < 0.001$), and attitude towards drip irrigation ($\beta = 0.488$; $P < 0.001$) had positive and significant effects on behavioral intention towards the acceptance of drip irrigation. With regard to the results, the standardized effect (β) of attitude is greater than other variables, which indicates the important and significant role of this variable in explaining the behavioral

intention towards the acceptance of drip irrigation. The variable of attitude towards the acceptance of drip irrigation was also a mediator within the framework of study (Figure 1). Thus, direct effects of the two variables of perceived ease of use and perceived usefulness on attitude towards the acceptance of drip irrigation were calculated. The results of this section suggested that both perceived usefulness ($\beta = 0.405$; $P < 0.001$) and perceived ease of use ($\beta = 0.237$; $P < 0.001$) had significant effects on acceptance attitude. Direct effects of innovation features on other mediators, including perceived ease of use and

Table 4. Direct effects on behavioral intention towards drip irrigation acceptance, attitude, perceived ease of use, and perceived usefulness.

	Independent variables	B	Beta (β)	t	Sig t
Direct effects on behavioral intention towards drip irrigation acceptance	Constant	-0.658	---	-1.07	0.282
	Perceived ease of use	0.189	0.148	3.264	0.001
	Perceived usefulness	0.261	0.230	4.796	0.001
	attitude	0.358	0.488	10.409	0.001
	Sig F= 0.001	F= 114.217	R^2_{Adj} = 0.516	R^2 = 0.521	R= 0.722
Direct effects on attitude	Constant	7.205	---	7.901	0.001
	Perceived ease of use	0.410	0.237	4.512	0.001
	Perceived usefulness	0.627	0.405	7.714	0.001
	Sig F= 0.001	F= 70.94	R^2_{Adj} = 0.304	R^2 = 0.309	R= 0.555
	Direct effects on ease of use	Constant	3.125	---	4.154
Testability		0.172	0.131	2.457	0.015
Relative advantage		0.042	0.033	0.599	0.550
Compatibility		0.351	0.373	6.472	0.001
Complexity		0.205	0.159	3.246	0.001
Visibility		0.280	0.110	2.881	0.001
Sig F= 0.001	F= 23.165	R^2_{Adj} = 0.265	R^2 = 0.268	R= 0.517	
Direct effects on perceived usefulness	Constant	2.104	---	2.696	0.007
	Testability	0.269	0.180	3.576	0.001
	Relative advantage	0.197	0.140	2.706	0.007
	Compatibility	0.359	0.341	6.271	0.001
	Complexity	0.159	0.111	2.367	0.019
	Visibility	0.283	0.160	3.494	0.001
Sig F= 0.001	F= 33.528	R^2_{Adj} = 0.336	R^2 = 0.346	R= 0.588	

perceived usefulness, were calculated. The results demonstrated that the variables of testability (β = 0.131; P < 0.01), compatibility (β = 0.373; P < 0.001), complexity (β = 0.159; P < 0.001), and visibility (β = 0.110; P < 0.01) have positive and significant effects on perceived ease of use. Furthermore, investigating effects of innovation features on perceived usefulness showed that these features positively and significantly affected perceived usefulness (Table 4).

A path analysis was employed to calculate indirect and total effects on the main dependent variable (Table 5, Figure 2). Among research variables, innovation features, including testability, comparative advantage, compatibility, complexity, and

visibility had indirect effects on behavioral intention through perceived ease of use and perceived usefulness. Comparing these effects suggested that indirect effect of compatibility was higher than other variables. In addition, calculation of total effects of all variables on the main dependent variable (behavioral intention) indicated that attitude, perceived usefulness, perceived ease of use, and compatibility had the highest total effects, respectively. Finally, it should be noted that the independent variables of the research were able to predict 59.3% of the variance of the behavioral intention, which partly related to adding innovation features (as the external variables) to the new model (Figure 2).



Table 5. Analysis of direct, indirect, and total effects of the variables on behavioral intention of drip irrigation acceptance.

No	Variables	Direct effects	Indirect effects	Total effects
1	Perceived ease of use	0.148	0.115	0.263
2	Perceived usefulness	0.230	0.197	0.427
3	attitude	0.488	---	0.488
4	Testability	---	0.110	0.110
5	Relative advantage	---	0.066	0.066
6	Compatibility	---	0.243	0.243
7	complexity	---	0.087	0.087
8	Visibility	---	0.095	0.095

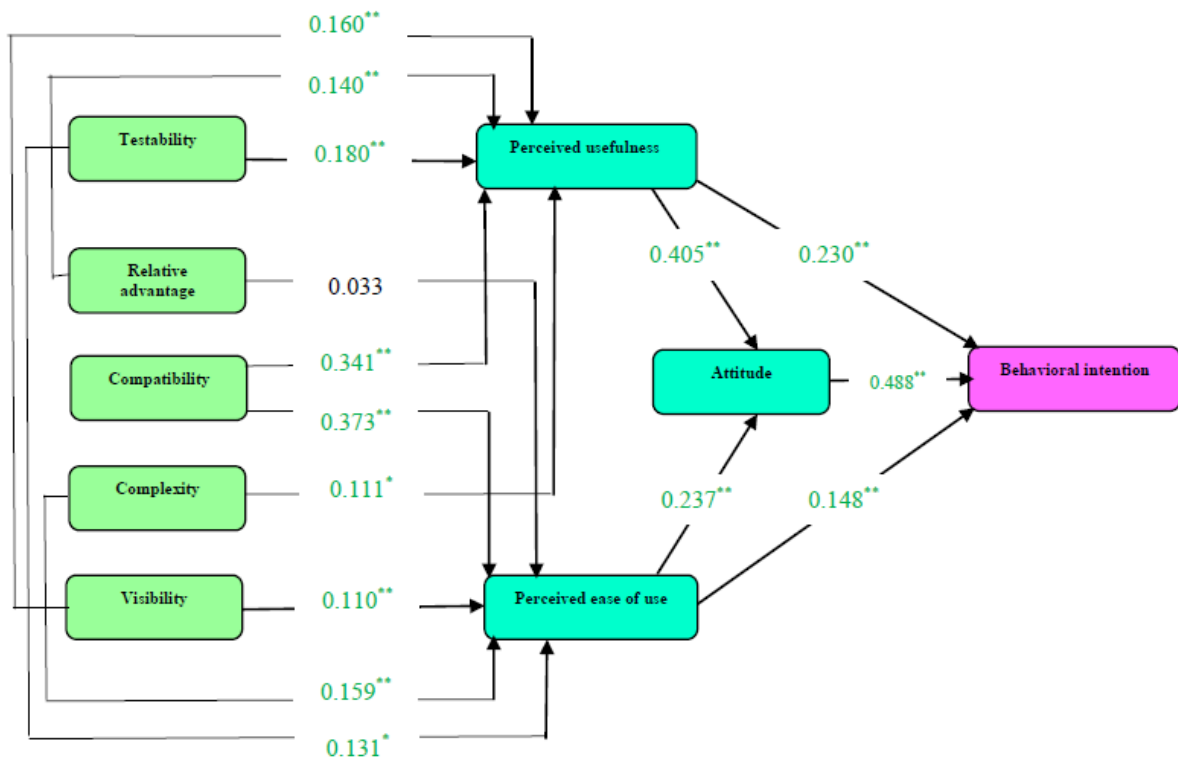


Figure 2. Path model of the study variables.

CONCLUSIONS

The main purpose of the present study was to analyze the acceptance intention towards drip irrigation among Iranian sugar beet growers based on an extended version of Technology Acceptance Model (TAM). The results of present study contributed to

development of more integrated and comprehensive models in the field of farmers' acceptance behaviors. It also provided practitioners, decision-makers, and policy makers of agricultural and water sectors (including Agricultural Jihad Organization, Ministry of Energy, and Department of Environment) with some useful insights regarding determinants and strategies of behavioral changes. Based on

the theoretical and empirical literature, the framework was formulated in a way that behavioral intention towards the acceptance of drip irrigation was influenced by attitude, perceived usefulness, perceived ease of use, and features of innovation (external factors). The results showed that attitude towards the acceptance of drip irrigation had the most impressive role in explaining farmers' intention towards the acceptance of drip irrigation technologies. This implies that reinforcing farmers' attitudes towards the acceptance of drip irrigation will increase the likelihood of activating behavioral intention towards these new irrigation methods. In addition, it should be noted that attitude towards the acceptance of drip irrigation technology in the first stage requires awareness about water scarcity and negative consequences of water scarcity and/or non-adoption of water-saving practices in agriculture. Therefore, if farmers are aware of adverse consequences of water scarcity and its negative impacts on agricultural societies, the level of change in their attitudes will increase. In this regard, field practitioners of agricultural extension and education (this group are responsible for behavioral changes in agricultural communities of Iran) are recommended to pay more attention to raising farmers' awareness and, consequently, improving their behavioral intention towards the acceptance of drip irrigation technology. This interventional action can also be done through television and radio programs that cover a wide range of farmers. Furthermore, it can be addressed in training programs that are being conducted in study area.

Based on the results, perceived usefulness was the second most powerful variable affecting farmers' behavioral intention towards the acceptance of drip irrigation. It can be inferred that the more sugar beet farmers understand the benefits of an innovation (drip irrigation), the more they intend to use this technology. In this regard, experts and practitioners of Agricultural Jihad Organization are suggested to increase their awareness about usefulness of these

technologies. These courses should focus on enlightening about the complexity of water issue/ problem and the significant role of new irrigation technology in this context.

One of the main determinants of behavioral intention towards the acceptance of drip irrigation was perceived ease of use. In other words, the results showed that with increasing ease of use, intention of farmers to accept this technology would increase. Based on field observations and interviews with sugar beet farmers during and before data collection, despite their tendency to use this technology, many of them have refused to accept it for a variety of reasons such as lack of availability and complexity. In this regard, designer companies and their experts are suggested to install these systems in a proper way and provide the key guides to run and keep the system up. This will resolve farmers' problems and increase ease of acceptance.

Among the features of innovation, compatibility had the most powerful indirect effect on farmers' behavioral intention. That is, the more drip irrigation is compatible with the situation of sugar beet growers, the more intention will be to use it. In other words, this result means that increase in compatibility can lead to favorable behavioral intention towards drip irrigation technology. Therefore, it is recommended to focus on compatibility of this technology with farming and land coverage system as well as with the context-specific conditions of farmers.

Finally, it should be noted that the variables used in this study were able to predict 59.3% of variation of behavioral intention towards the acceptance of drip irrigation. Unexplained variance of dependent variable implies that other variables can also be found within the framework in order to increase the level of explanation. For example, subjective norms, perceived behavior control, self-efficacy, and personal relationships that seem to be in relation with behavioral intention towards the acceptance of drip irrigation can possibly be suitable determinants. In this regard,



future studies are suggested to address the effects of these variables on farmers' behavioral intentions.

Similar to most other studies, this research had also some limitations. First, it should be mentioned that this research was carried out based on a face-to-face survey among Iranian sugar beet farmers. However, employing mixed methods might provide more meaningful insights about farmers' intention towards the acceptance of drip irrigation. Thus, future research is recommended to bridge this gap. In applying mixed method approach to analyze farmers' acceptance intention and behavior, it should be kept in mind that not only this approach can be used in indicator development stage (generating scales to measure constructs), but also it can be used in data collection, model validation, and data analysis stages. The second limitation was related to the unavailability of a set of reference data about the main socio-demographics of population. Existence of such reference data can set a ground and basis for validating and comparing the results of this study. The third limitation of this study related to the analyzed variables. The study just used a mixture of the variables of TAM and IDT to analyze farmers' intention towards the acceptance of drip irrigation. However, future studies can definitely apply other independent variables and/or theories to analyze farmers' intention and behavior. The fourth limitation of the present study was that the authors used SPSS for analyzing the data. However, using the structural equation modeling and modeling packages like LISREL, AMOS, EQS, and so on can provide more suitable and reliable framework and model.

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تحلیل نیت رفتاری کشاورزان ایرانی نسبت به پذیرش آبیاری قطره‌ای با استفاده از الگوی توسعه‌یافته‌ی پذیرش فناوری

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چکیده

هدف مطالعه‌ی حاضر تحلیل نیت کشاورزان چغندرکار نسبت به پذیرش آبیاری قطره‌ای بر اساس نسخه‌ی توسعه‌یافته‌ی الگوی پذیرش فناوری است. اهداف اختصاصی این پژوهش شامل معرفی نظریه‌های موجود رفتار پذیرش، مقایسه‌ی انتقادی این نظریه‌ها، ارائه‌ی یک چارچوب مفهومی بر اساس الگوی پذیرش فناوری و آزمون روابط احتمالی میان متغیرها است. این مطالعه‌ی توصیفی - همبستگی با استفاده از یک پیمایش مقطعی انجام شد. جامعه‌ی آماری مطالعه، چغندرکاران شهرستان میاندوآب در ایران بودند که ۳۴۶ نفر از آنها با استفاده از روش نمونه‌گیری تصادفی طبقه‌ای چندمرحله‌ای به عنوان نمونه انتخاب شدند ($N=3326$). ابزار پژوهش، پرسشنامه‌ای ساختارمند بود که روایی ظاهری، همگرا و تشخیصی آن مورد تأیید قرار گرفت. ضرایب آلفای کرونباخ و روایی ترکیبی برای بررسی پایایی ابزار پژوهش مورد استفاده قرار گرفت ($0.93 < \alpha < 0.94$). نتایج نشان داد که متغیرهای نگرش، سهولت استفاده‌ی درک‌شده و سودمندی درک‌شده اثرات مثبت و معنی‌داری بر روی نیت رفتاری نسبت به پذیرش فناوری آبیاری قطره‌ای داشتند. ویژگی‌های نوآوری هم دارای اثرات غیرمستقیمی بر روی نیت رفتاری بودند. افزون بر این، نتایج حاکی از آن بودند که متغیرهای مستقل الگوی توسعه‌یافته‌ی پذیرش فناوری توانستند ۵۹/۳ درصد از تغییرات واریانس نیت رفتاری نسبت به پذیرش آبیاری قطره‌ای را پیش‌بینی کنند. اثر معنی‌دار نگرش نسبت به پذیرش آبیاری قطره‌ای بر تبیین نیت رفتاری نشان می‌دهد که تقویت نگرش‌های کشاورزان احتمال فعال‌سازی نیت رفتاری نسبت به پذیرش این روش‌های جدید آبیاری را افزایش خواهد داد. به صورت کلی، نتایج این مطالعه به توسعه‌ی الگوهای یکپارچه‌تر و جامع‌تر در زمینه‌ی رفتارهای پذیرش کشاورزان کمک کرد. همچنین، این مطالعه بینش‌های مفیدی را در زمینه‌ی تعیین‌کننده‌ها و راهبردهای تغییرات رفتاری پیش روی عمل‌گران و سیاست‌گذاران بخش‌های کشاورزی و آب قرار می‌دهد.