

FACTORS AFFECTING THE USE INFORMATION AND COMMUNICATION TECHNOLOGY IN MANAGING GREENHOUSE

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Abstract

In recent years, information and communication technology in the field of e-commerce has reduced many of the challenges of business development. E-commerce can be used to develop the agricultural sector and to market agricultural products. This research is a survey aimed at evaluating the adoption of greenhouse owners to Affecting the use information and communication technology in managing greenhouse units in Isfahan Township. The type of research is descriptive-analytic. The statistical community is about 460 and 197 number of sample units are accidentally chosen using Cochran formula with possible precision. The research method was library and field based. After determining the indices and variables of the research, a researcher-made questionnaire was used to collect the required statistical data in the study area. The main tool of the research is questionnaire and its processing is done in the software Spss21. The reliability of questionnaire has been gained through using cronbach alpha also the validity of the research was also calculated using the KMO coefficient higher than 0.7. Results of this research showed that 10 percent greenhouse owners have started accepting the use information and communication technology in managing greenhouse units. The results of the research show that there was a correlation between the level of education, job satisfaction and income level with the components of adopting, decision, persuasion, and knowledge of meaningful and positive. The results of regression analysis also show that variables such as age, job, experience and communication channels, psychological factors and decision describe 46 percent of the dependent variable of accepting the use of the internet.

Key words: E-commerce, adoption, greenhouse owner, marketing.

INTRODUCTION

One of the important changes in today's society is the emergence of information and communication technology that has many benefits, and despite the many benefits, the development and deployment of this technology alone is not enough to enjoy these benefits, but the technology must be used by the user (Amiri et al., 2015). In the information and communication age, greenhouse owners' access to new communication technologies such as the Internet and other virtual and communication spaces has a tremendous impact on the progress of life. In order to achieve the goals of comprehensive economic, social and cultural development of the country, serious measures must be taken to use information and communication technology (Mohtarami & Sha'banollah, 2013). Information technology is the collection,

organization, storage, and dissemination of information, including audio, video, text, and numbers, or any other three devices using computer and telecommunications tools (Rezaei, 2009).

Information and communication technologies have been introduced as the dominant technology in the new millennium. These technologies have become a tool for promoting efficiency and growth in all areas of human activity by speeding up the information exchange process and reducing related costs. The benefits of using these technologies are tangible and feasible in all sections of society. Obviously, the agricultural sector will benefit from these technologies along with other sectors (Sarrami & Bahari, 2011). In other definition, information and communication technology can be called information production, transmission and distribution technology (Rezaei, 2009). The ability to use

the Internet to market agricultural products is a significant advantage of this new technology (Yang & Zhang, 2015).

In recent years, the rapid growth of information and communication technologies has had a very significant impact on human life and the functioning of organizations and institutions in different countries (Mohtarami et al., 2013). Internet access has also increased among agricultural producers. Also its demographic transition is also marked by a greater tendency to use technology among agricultural communities (Yasobi, 2009). If information and communication technology is considered as an innovation, the theory of innovation dissemination and its equivalent, the theory of technology acceptance, share the view that they determine the acceptance of a particular information and communication technology through the characteristics that are perceived by it. In addition to the structures used in the technology acceptance model, they are essentially the shaping factors of a set of perceived features about innovation (Verdouw et al., 2016).

The dissemination of innovation, according to Rogers (2004), is the process by which innovation spreads through certain channels over time among members of a social system (Sarrami & Bahari, 2011). This process can not be realized without a concept called technology acceptance. In fact, innovation acceptance refers to the steps and reasons on which the audience chooses and adopts a product-innovation. Rogers refers to innovation as the type of idea, product, or service that is new to an individual, organization, or audience (Hosseini-Khah, 2008). Innovation dissemination theory considers the dissemination of innovation as a special type of communication process in which a message about a new idea is transmitted from one individual to another in society, and it is assumed that the acceptance rate according to people's perception of character. The characteristics of an innovation, known as the characteristics of innovation, are determined (Yang & Zhang, 2015; Dearing & Cox, 2020). The model of publishing acceptance is based on the hypothesis that people have capacities and if they become aware of a subject, they will look at it and then accept it. Modernity is the

tendency to embrace a new technology. In other words, modernity is the degree of interest in trying a new concept or a new product or service.

According to innovation diffusion theory, the acceptance of a new technology is closely related to the desire to try and accept new things. Individual modernity is an important factor influencing the acceptance of new technology (Dinpanah et al., 2005; Stewart et al., 2019; Dearing & Cox, 2020).

Some people are more willing to take the test of an innovation, while others seem reluctant to change their ways. Because in innovation dissemination theory, individuals react differently to the acceptance of an innovation because of their differences in modernity, they fall into five categories in terms of acceptance of the innovation: Innovators, Early adapters, Early majority, Late majority, and Laggards. In the theory of innovation dissemination, in describing the differences in communication behavior between the first adopters and the slow adopters, it is mentioned that the first adopters show more social participation and socialize with others through interpersonal networks. Also, the first adopters have more contact with innovators. More exposed to interpersonal communication channels (Yang & Zhang, 2015; Stewart et al., 2019; García-Avilés, 2020; Dearing & Cox, 2020).

This model considers acceptance factors such as access to information about an innovation, age, background, and level of contact with the promoter. According to Rogers, the stages of innovation dissemination are: Knowledge, Encouraging, Decision and Stabilization. In addition, the characteristics of innovation in Rogers' view are: Relative Advantage, Competitive, Compatibility, Complexity, Practicability and Observable. Each of the above characteristics is interrelated with the four characteristics of the admission process.

Relative Advantage: The extent to which people perceive innovation to be better than the previous approach that innovation seeks to replace.

Competitive: Cost-effective and better innovation performance

Compatibility: The extent to which people perceive the harmony of existing and valuable innovations and past experiences and needs

Complexity: The extent to which people understand the difficulty of learning to apply innovation and its ease of use.

Practicability: Ability to review and test innovation.

Observable: The extent to which innovation results for others (Alavion et al., 2017).

In innovation dissemination theory, it is believed that users' mental perceptions of innovation features affect their acceptance (Rezaei, 2009).

Literature review

Mira et al. (2004) examined the role of information and communication technology in India's agricultural development. This study examined the performance of three ICT projects in India. The results showed that although these projects were different according to the type of services provided, but their general similarity can be seen in areas such as: information, marketing, consulting, information on rural development programs and other information from government sources (Mira et al., 2004).

Al-Qahtani (2004) in a study examined the relationship between the five characteristics of computer technology and its acceptance based on Rogers' theory of diffusion innovation. The results of this study showed that the feature of technology complexity is the strongest and most effective factor among the five features of technology in promoting or preventing the adoption of information and communication technology (Al-Qahtani, 2004).

Dadi et al. (2004) in a study on the analysis of technology selection time in Ethiopia. Estimated patterns indicate that farmers had the greatest impact on infrastructure prior to the adoption of new technologies (especially proximity to the market). Other influential agricultural factors (agricultural land area, labor force and credit) Farmers' personal characteristics (level of education, gender, age) had little effect on the admission process (Dadi et al., 2004).

Shu et al. (2007) examined the factors affecting the acceptance of improved potato cultivars by farmers. The results of this study showed that factors such as land rent, cow ownership, contact with promoters, age and level of education have a positive effect as well as size variables Households had a negative effect on

the acceptance of potato cultivars (Shu et al., 2007). Ismaili et al. (2013) Examined internet marketing and web-based agricultural services. The results of this study indicate that many websites in the field of agriculture in the world are public and private. Of course, many of them are government-owned and provide government information and services to farmers and activists in the sector (Ismaili et al., 2013).

Mohtarami et al. (2014) studied the factors affecting the adoption of information technologies in organizations. Result of research showed that factors such as: managers' perceptions of the benefits and challenges of information technology, organizational size, management stability, readiness of suppliers, impact. It has a positive effect on the desire to adopt information technology in organizations (Mohtarami et al., 2014).

Verdouw et al. (2016) examined the process of Internet marketing for fish products in the Netherlands and concluded that online marketing can adequately solve supply chain problems and the use of Internet marketing can reduce the complexity of decision making in these areas (Verdouw et al., 2016).

Mutheu (2018) investigated the usefulness of ICT interventions identified and adopted by farmers in Kenya. result research showed that farmers will be able to use ICTs available to them to share experiences and seek information, buy and sell through online platforms and access financial services from their mobile phones, use in build computer programs for record keeping and financial management as well as adopt technologies by simply watching videos and demonstrations from online sources among other possibilities (Mutheu, 2018).

Wawire et al. (2018) specified that adopting ICTs is the only solution for smallholder farmers in achieving their farm returns and improving their livelihoods as the farming landscape has changed significantly in the 21st century (Wawire et al., 2018).

Mdoda et al. (2020) research result, suggested that the government must subsidize farmers so that they can be able to purchase data and ICT tools (Mdoda et al., 2022). Zhang et al. (2022) research result, emphasised that the ICT can potentially separate the economy from the

environment, in other words, in addition to economic development, also pay attention to the environmental aspects of development.

Based on the studies, the theoretical framework of the research was presented in Figure 1.

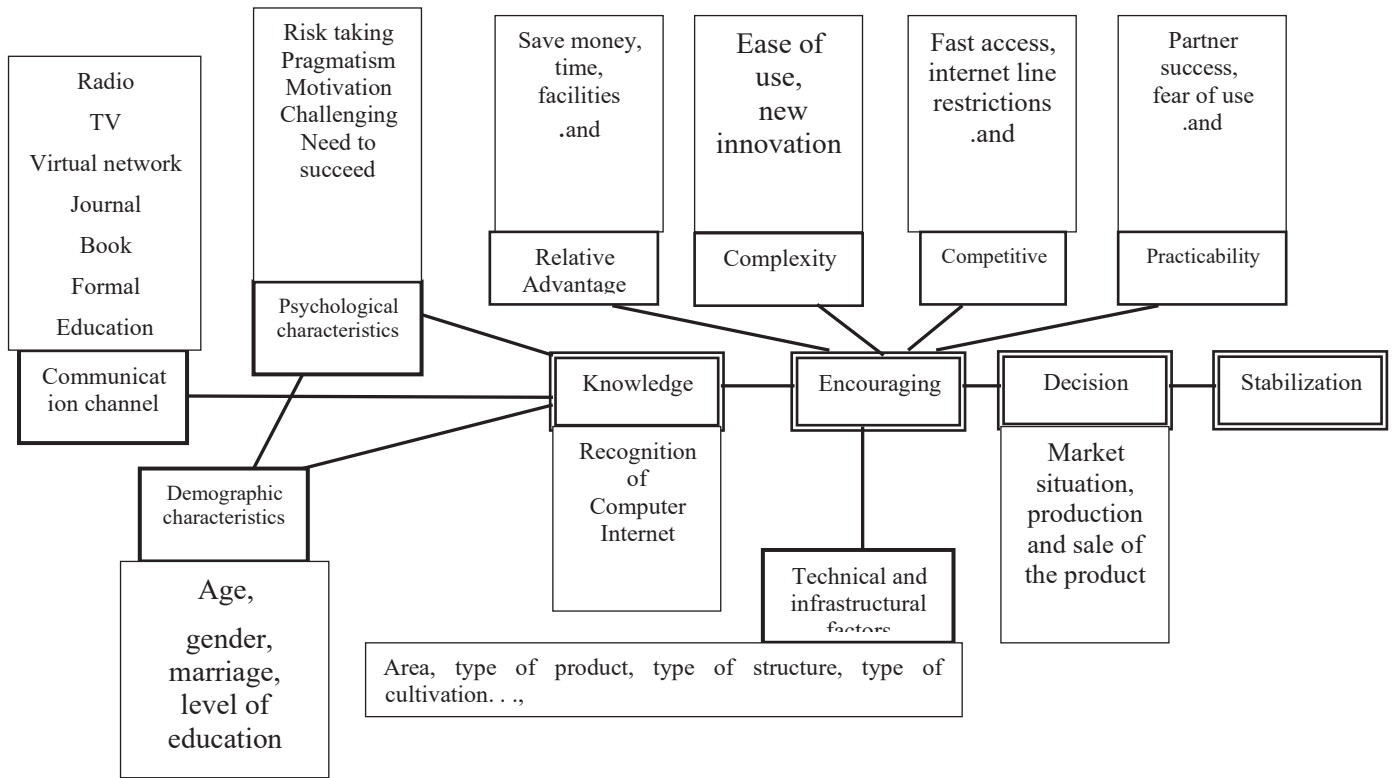


Figure 1. Conceptual model of research

MATERIALS AND METHODS

The present study is an applied research in terms of purpose and descriptive-survey research in terms of data collection (Sarmad et al., 2015). This research is also a type of field research in which the researcher is present to collect data in the desired areas. Part of this research has also examined related articles and books, which can be called non-field studies or library studies. In this study, multi-stage sampling with proportional assignment was used. Cochran's formula was also used to determine the sample size. In the present study, the statistical population of greenhouse owners in Isfahan was 460 units, of which 197 samples were randomly selected based on the relevant formula.

In this research, Cronbach's alpha method was used to determine the reliability of the instrument. In order to assess the reliability of the questionnaire, a pretest was conducted in 20 poultry units. Cronbach's alpha for the whole questionnaire was 0.800 (Equation 1 was used to calculate Cronbach's alpha).

Equation 1:

$$a = \frac{k}{k-1} \left[1 - \frac{\sum_{i=1}^k s_i^2}{\sigma^2} \right]$$

Table 1. Cronbach's alpha coefficient for questionnaire elements

Component	Number of variable	Cronbach's alpha coefficient
Awareness	5	0.758
Encouraging	20	0.892
Decision	4	0.701
Communication channels	9	0.855
Psychological factors	16	0.853

Source: Research findings

The KMO coefficient was used for factor validity of the research instrument (questionnaire), which was calculated and it was convenient.

The value of KMO was larger than 0.5. Therefore, it is concluded that the number of samples is suitable for factor analysis since KMO value is between 0 and 1 and the closer to 1, the higher the sample validity (Emin et al., 2007).

Table 2. KMO measure and Bartlett's test to assess appropriateness of the research instrument

Scale Name	KMO	Bartlett's test of Sphericity	
Awareness	0.711	Approx. chi-square (333.642)	Sig (0.000)
Encouraging	0.852	Approx. chi-square (1557.540)	Sig (0.000)
Decision	0.656	Approx. chi-square (217.890)	Sig (0.000)
Communication channels	0.872	Approx. chi-square (829.764)	Sig (0.000)
Psychological factors	0.856	Approx. chi-square (1100.427)	Sig (0.000)

Source: Research findings

RESULTS AND DISCUSSIONS

The average age of greenhouse owners were 47 years.

The level of education of most of them was at the level of diploma. 87% of them were men and only 13% of greenhouse owners were women.

The average greenhouse area was about half a hectare (0.57 ha).

Table 3. Descriptive statistics of the study population (Managing Greenhouse)

Variables	Frequency	Percent	Cumulative percent
Age (years)			
38<	110	55.8	55.8
38-58	77	39.1	94.9
58-78	8	4.1	99
>78	2	1.0	100
Total	197	100	-
Educational level			
High school	39	19.9	19.9
Diploma	58	29.4	49.3
BSc	58	29.4	78.7
MSc	26	13.2	91.9
PhD	16	8.1	100
Total	197	100	-
Agricultural experience			
10<	143	72.6	72.6
10-20	40	20.3	92.9
20-30	9	4.6	97.5
>30	5	2.5	100
Total	197	100	-
Marital status			
Married	175	88.8	88.8
Single	22	11.2	100
Total	197	100	
Gender			
Female	24	12.2	12.2
Man	173	87.8	100
Total	197	100	
Family size			
3≥	98	49.8	49.8
4-5	90	46.6	95.4
>5	9	4.6	100
Total	197	100	-
Greenhouse area			
0.01 ha≥	13	6.6	6.6
0.01-0.5	112	56.9	63.5
0.5-1	60	30.5	93.9
>1ha	12	6.1	100
Total	197		
Greenhouse type			
Hydroponic	15	7.6	7.6
Non-hydroponic	182	92.4	100
Total	197		

Source: Research findings

The level of satisfaction of the greenhouse owner with the working conditions in the greenhouse was also evaluated by 5-Likert scale (VL=very low, L=low, M=medium H=high and VH= very high). The research results showed that the satisfaction of greenhouse owners has been relatively good.

Table 4. The level of satisfaction of the greenhouse owner with the working conditions

satisfaction	5-point Likert scale				
	VL%	L%	M%	H%	VH%
The level of satisfaction	11.2	9.6	49.8	27.4	2.0

Source: Research findings

The results of the research show that in the context of the component "type and amount of communication channels", greenhouse owners

use their other colleagues and the way to find information from them.

Table 5. Priority recognition communication channels

Rank	Item	5-point Likert scale					Mean	Sd	CV
		VL%	L%	M%	H%	VH%			
3	TV	24.4	57.4	14.2	2.53	1.5	1.99	0.892	0.448
5	Radio	57.4	33.5	7.6	1.5	0.0	1.53	0.704	0.460
4	Book	34.5	52.8	8.1	2.5	2.0	1.85	0.831	0.449
7	Journal	46.2	42.6	5.6	2.5	3.0	1.74	0.910	0.523
9	Virtual network	20.3	23.9	31.5	12.7	11.7	2.72	1.254	0.461
6	Formal education	54.3	28.4	8.6	5.6	3.0	1.75	1.033	0.590
2	Family and friends	18.3	15.7	34.0	20.8	11.2	2.91	1.242	0.427
1	Other greenhouse owners	13.7	19.8	32.0	21.3	55.7	3.01	1.223	0.406
8	Extension worker	47.2	34.5	7.6	6.1	4.6	1.86	1.091	0.587

Source: Research findings

The result of research showed that there was significant correlation between the use of the internet in greenhouse and variable such as:

Age, Level of Education, Income, Satisfaction, Greenhouse area and Experience (Table 6).

Table 6. Correlation between accepting the use of the internet in greenhouse and variable other variables

Variables	Correlation coefficient			
	Awareness	Encouraging	Decision	Stabilization
Age	-0.452**	-0.180*	-0.196*	-0.221**
Level of Education	0.580**	0.259**	0.193**	0.393**
Income	0.148*	0.231**	0.217**	0.075
Satisfaction	0.215**	0.223**	0.186**	0.210**
Greenhouse area	0.194**	0.098	0.107	0.128
Experience	0.191**	0.166*	0.160*	0.275**

*Significant at 0.05 levels ($p < 0.05$); **Significant at 0.01 levels ($p < 0.01$), Source: Research findings

The results showed that the correlation between the age variable with the components of stabilization, decision, encouraging and awareness of innovation is significant and negative. Also the correlation between the level of education, work experience and satisfaction of greenhouse owners with the components of stabilization, decision, encouraging and awareness of innovation is significant and positive. But the greenhouse income variable has a positive and significant relationship with variables such as awareness, encouraging and decision and the greenhouse level variable has a positive and significant relationship with the awareness variable.

Multiple regression was used to predict the variables affecting acceptance. The adjusted coefficient of determination in the model is equal to 0.462, which indicates that in the model 46% of the changes in the acceptance of Internet use are related to the components of education level, secondary job, market experience, formal education, family education, motivation, decision and persuasion.

Table 7. Summary of regression model of factors affecting the acceptance of innovation in the use of ICT

Model	R	R ²	R ² _{adj}	Standard Error
Enter	0.818	0.668	0.462	7574.010

Source: Research findings

Also, the summary of analysis of variance of the regression model shows that the value of F (3.238) obtained in the model is significant at the error level less than 0.05, so the research variables have high explanatory power and are able to change the variance of the dependent variable well explain (Information and Communication Technology Adoption).

Table 8. Summary of ANOVA

Sources of change	Sum of the average	df	Average squares	F	Sig
Regression	1042	28	374.725	3.238	0.000
Residual	207.484	45	115.723		
Total	15699.799	73			

Source: Research findings

The multiple regression analysis was used to analyze the accepting the use of the internet in greenhouse management.

Table 9. Influential factors on the factors affecting the acceptance of innovation in the use of ICT

Variables	B	Standard Error	Beta	T	Sig.
Fixed coefficient	-77.372	25.138	-	-3.078	0.004
Level of Education	6.221	1.961	0.428	3.167	0.003
Sub-job	-3.225	1.328	-0.292	-2.429	0.019
Market experience	1.529	0.699	0.288	2.184	0.034
Formal training	5.145	1.498	0.391	3.435	0.001
Family training	5.482	1.963	0.404	2.793	0.008
Motivational	3.863	1.849	0.293	2.089	0.042
Innovation test	1.088	0.493	1.061	2.207	0.032
The complexity of innovation	-1.283	0.530	-1.218	-2.421	0.020

Source: Research findings

According to the regression coefficient the regression line equation could be written as:

$$Y = -77.372 + 6.221 x_1 - 3.225 x_2 + 1.529 x_3 + 5.145 x_4 + 5.482 x_5 + 3.863 x_6 + 1.088 x_7 - 1.283 x_8$$

x_1 = Level of Education;

x_2 = Sub-job;

x_3 = Market experience;

x_4 = Formal training;

x_5 = Family training;

x_6 = Motivational;

x_7 = Innovation test;

x_8 = The complexity of innovation.

CONCLUSIONS

The overall result of the present study states that there was ICT knowledge but the main problem of the greenhouses was the acceptance and application of this new technology. Of course, the present result is confirmed by the results of Shabanalhi et al. (2011) research. The results show that human capital with desirable characteristics such as youth, risk-taking have entered this field, but the presence of women as an influential and educated segment of society in this area is still weak. Meanwhile, more than half of the graduates in the agricultural sector are women.

The results show that the level of satisfaction of half (50%) of greenhouse owners is high, which indicates the appropriate socio-economic conditions in this group of society according to its general conditions. Satisfaction is obviously the result of various economic, social and cultural parameters of society and the relevant statistics show that more than half of greenhouse owners have relative satisfaction, so this can be a basis for accepting new innovations.

According to the research results in the field of the type and amount of communication channels, the most use is related to colleagues. It seems that greenhouse owners have not been able to use appropriate communication and information channels such as specialized experts, information resources such as websites, magazines, etc. Perhaps one of the reasons for the lack of proper acceptance is the lack of technical infrastructure and knowledge in greenhouse owners to use information channels in this is the field.

The results show that the process of accepting innovation in the use of information and communication technology in the management of greenhouse units is still slow and limited to the innovation population in the greenhouse community. As Rogers's theory of innovation acceptance states that in the beginning acceptance of innovators is a condition for starting the process of acceptance of innovation, but emphasizes that until a quick majority of society enters the process of acceptance of innovation, a suitable starting point for acceptance of innovation cannot be imagined.

The results show that the correlation between the variable of education level, income and job satisfaction with the components of consolidation, decision, persuasion, awareness was significant and positive. According to the research findings, 90% of the greenhouse owners have not yet entered the decision process to accept innovation in the use of information and communication technology in the management of greenhouse units. It started with people with a high level of education, a sufficient income and relative job satisfaction. The results also show that there is a significant and positive correlation between the variable of market experience with the components of consolidation, decision, persuasion, awareness

and risk level of greenhouse owners. It seems that considering the importance of the experience parameter and its role in accepting the use of information and communication technology in the management of greenhouse units, it seems that the process of dissemination of this innovation should start with people who have appropriate experience in product marketing.

The results of regression analysis to examine the variables affecting the acceptance of innovation in the use of information and communication technology by greenhouse owners show that ultimately people accept the use of information and communication technology in the management of greenhouse units that at least on a limited level and as a pilot (Initial testing) in the process of buying input or selling the final product to experience the marketing process that most of these people have the appropriate psychological characteristics such as motivation of appropriate individual characteristics (such as: level of education and market experience) as well as access to communication channels and testing Primary innovation is on a small scale.

In addition, the results show that in the estimated regression model, 46% of the changes in the acceptance of the use of information and communication technology in the management of greenhouse units are related to the components of education level, sub-job, market experience, formal education, family and friends. Motivation depends on the innovation test and its complexity.

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