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Factors influencing the adoption of information and communication technologies by farmers: The case of Yozgat province in Türkiye

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Abstract

The adoption of technologies and the effective use of resources in the development of agricultural production are important in rural areas. This study has four objectives. First, to determine the purpose of farmers' use of information and communication technologies (ICTs); second, to identify the barriers to ICT use; third, to determine the factors affecting the use of ITC; and fourth, to explain the relationship between ICT use and socioeconomic variables. To achieve this goal, data were collected from 211 farmers who grow wheat in Sarıkaya district of Yozgat province through a survey. Farmers' reasons for using ICT and barriers to ICT use were explained using descriptive statistics. The relationship between ICT use and socio-economic variables was explained by Spearman's Rho correlation. The effects of the factors on ICT adoption and use were calculated using structural equation modeling. The research results show that the three main barriers to the use of ICT by farmers are insufficient knowledge, traditionalism of farmers and high costs. It was found that farmers mainly use ICT for communication, weather forecasting and general information search. Perceived benefit was found to have a 42% influence on the adoption and use of ICT by farmers, attitude had a 41% influence and perceived benefit had a 49% influence on attitude. As perceived benefit has an impact on both attitude development and ICT use, it can be suggested as a result of this research that practical training and projects be carried out to enable farmers to perceive the benefits of ICT.

1. Introduction

The development and diffusion of new agricultural technologies and their adoption and use by farmers could lead to a significant increase in agricultural productivity in low- and middle-income countries around the world in rural areas (Lowder et al., 2016). The integration of information and communication technology (ICT) into agricultural production processes increases the efficiency of food production (Heeks & Bukht. 2018). As a result of the introduction and use of ICT by farmers, their income can increase (Landmann et al., 2021). The use of ICT in agriculture can offer various benefits, such as cost reductions and an increase in production and market share (Aker, 2011; Rao, 2007; Sekabira & Qaim, 2017). The use of ICT by farmers in Nigeria has been shown to have a significant impact on agricultural production (Adeyemi et al., 2023). The use of ICTs in rural areas has important functions when it comes to increasing farmers' income and ensuring sustainable agriculture (Rao, 2007). For example, the impact of cell phone and internet technology use on agricultural profits in Pakistan was estimated to be around 41% (Khan et al., 2022). The purpose of ICT use by farmers and the barriers to its use vary according to the level of development of countries and regions. Identifying the barriers to ICT adoption by farmers, the purposes of ICT use and the factors that influence ICT use are important for developing policies and interventions. The aim of this research is to identify the purposes of ICT use by farmers in Türkiye, the barriers to ICT use and the factors influencing ICT use.

Farmers use ICT for many different purposes. According to data collected from 100 farmers in the Dhenkanal district of Odisha, India, farmers use ICT for general communication and entertainment purposes (Panda et al., 2019). Farmers in Qena governorate in Upper Egypt use ICT to learn about new

agricultural products, increase the productivity of their land, gather market information and obtain information on animal husbandry (Mansour, 2024). In Kenya, about 25% of farmers use ICTs to get information about farming and livestock, 23% to get information about buying and selling products and about 20% to issue warnings (Krell et al., 2021). ICT can also be used to access weather information (Baumüller, 2013), monitor agricultural meteorological data and manage risk (Hansen et al., 2007). Farmers in sub-Saharan Africa are reportedly using ICTs to increase the productivity of their livestock (Mdoda & Mdiya, 2022).

The barriers to ICT adoption vary from country to country and region to region. Despite the many benefits of ICT in agriculture, the acceptance of ICT in agriculture is still low in developing countries due to problems such as infrastructure. Lack of knowledge, high costs and language barriers in Sri Lanka (Subashini & Fernando, 2017), costs, high tariffs and language skills in Nigeria (Yekinni et al., 2019) and "lack of time" and "lack of access" in Tamil Nadu, India (Prathap et al., 2021) are among the main barriers to ICT adoption. Farmers' barriers to ICT adoption can be examined from three perspectives: socio-economic barriers, policy and institutional barriers (Mdoda & Mdiya, 2022) and behavioral barriers (Tulinayo et al., 2022).

Socio-economic barriers to ICT use include financial unaffordability, high prices for technology products (Mwangi & Kariuki 2015; Saidu et al., 2017), low income (Krell et al., 2021), lack of technical skills, illiteracy, low education (Owusu et al., 2017), high internet costs (Phiri et al., 2019), limited awareness of the benefits of ICT (Milovanović 2014; Mwangi & Kariuki 2015; Phiri et al., 2019), poor technical infrastructure (Evans 2018; Misaki et al., 2018) and limited access to mobile phones (Krell et al., 2021; Owusu et al., 2017; Phiri et al., 2019). According to the results of studies conducted with low-income groups, the barriers can be categorised into four groups: lack of motivation and interest, lack of skills and education, lack of financial resources and lack of awareness of electronic services and opportunities to use the internet (Aerschot & Rodousakis, 2008). There are also psychological barriers, the fear of making or breaking mistakes when using ICT (Urquhart et al., 2008), and cultural differences (Guttman et al., 2017).

Policy and institutional barriers to ICT use include: policy barriers (Mwaniki 2006; Saidu et al., 2017), inappropriate ICT policies (Barakabitze et al., 2015; Evans 2018; Munyua et al., 2009), limited agricultural knowledge of farmers and lack of agricultural extension centres (Kante et al., 2016; Phiri et al., 2019), lack of up-to-date information (Agyekumhene et al., 2018), incomplete and inadequate use of information (Mwaniki, 2006), lack of or weak institutional structures, ICT strategies and policies (Barakabitze et al., 2015; Kante et al., 2016) and complexity or simplicity of ICT (Long et al., 2016; Mwangi & Kariuki, 2015).

Behavioural barriers to ICT use; smallholder farmers' reluctance to adopt ICTs and trust issues (Mwakaje, 2010; Parikh & Lazowska, 2006), resistance to change due to socio-cultural differences and beliefs (Alobo Loison, 2015; Mwakaje, 2010), mismatch between farmers' needs and goals (Kante et al., 2016; Tata & McNamara, 2016), ICT literacy issues (Kale et al., 2015; Saidu et al., 2017), age and gender

(Beuchelt, 2016; McNamara & Buggy, 2017; Mwombe et al., 2014; Tata & McNamara, 2016), lack of ICT in local languages but in English (Dutta, 2009; Parikh & Lazowska, 2006; Phiri et al., 2019), attitude, accessibility and technical barriers (Anyan & Frempong, 2018) and the social, economic and behavioural distance between farmers who have access to the internet and those who do not (Phiri et al., 2019; Tahiru et al., 2019). In addition, advanced age, small landholdings and lack of education are also important barriers to ICT use and adoption.

The relationship between age, education level, income, land size and farming experience of farmers and ICT adoption and use of ICTs is important. Most studies have found that there is a strong and significant relationship between ICT use and age, gender, income, farm size and education (Drewry et al., 2019). In the South African district of Mbombela, it was highlighted that there is a correlation between demographic variables such as age, education level and household size and ICT use (Tologbonse et al., 2010). In a study examining 52 articles from around the world, it was found that factors such as age, education, gender and income are related to ICT use in developing countries and that young farmers are more likely to use ICTs (Amoussouhoui et al., 2024). The use of smartphone-based technologies in agricultural administration has increased in recent years. The reason for this is the ease of use, the positively perceived benefit and the development of a positive attitude due to the benefits.

In a study of New Zealand dairy farmers, it was found that farmers are influenced by perceived benefits and ease of use when adopting new technologies (Flett et al., 2004). Perceived benefit, which is interpreted as the extent to which a person believes that the use of a particular technology will improve their work performance, is an important factor in the adoption and use of new technologies (Davis, 1989; Taylor & Todd, 1995). In other words, perceived benefit also refers to a person's perception of the positive consequences of a behavior (Leung, 2013). In this regard, perceived benefit is an important source of motivation for ICT adoption (Liu et al., 2010; Prathap et al., 2021). A study in Uganda emphasized that it is important that a smartphone application is as user-friendly as possible and tailored to the users' needs (Ahikiriza et al., 2022). There is a positive correlation between the perceived benefit of ICT use and attitudes (Rosli & Saleh, 2024). Attitudes are a crucial factor in explaining behavior (Oeldorf-Hirsch & Chen, 2022). In an article examining the factors influencing the use and adoption of agricultural drones by farmers in Türkiye, it was found that farmers' agricultural income and a positive attitude towards technology positively influence the use and adoption of agricultural drones, while farmers' age has a negative influence (Parmaksiz & Cinar, 2023).

One of the many models that have been developed to explain technology acceptance is the Technology Acceptance Model (TAM) developed by Davis. Davis' model is the most frequently used model in studies on the use of information systems (Venkatesh, 2000). The TAM is based on the Theory of Rational Action (Ajzen, 1980), a psychological model that assumes that attitudes toward technology play an important role in determining behavior, and the Theory of Planned Behavior (Ajzen, 1991). The TAM is a model that assumes that the acceptance and use of a technology is determined by two basic components, namely attitude and perceived benefit (Davis et al., 1989). The TAM, a psychological model, has become one of the basic models used to understand the predictors of human behavior in relation to

the potential acceptance or rejection of an innovative technology (Kowalska-Pyzalska, 2024). In this respect, the TAM can serve as an important model to explain the adoption of ICT by farmers. The hypotheses about the relationship between ICT use and socio-economic variables as well as the statistical hypotheses about the factors influencing behavior were formulated as follows.

H_1: There is no relationship between ICT use and age.

H_2: There is no relationship between ICT use and income.

H_3: There is no relationship between ICT use and education.

H_4: There is no relationship between ICT use and land size.

H_5: There is no relationship between ICT use and Agricultural Experience.

H_6: Attitudes have no effect on ICT adoption behavior.

H_7: Perceived benefit has no effect on ICT adoption behavior.

H_8: Perceived benefit has no effect on ICT attitudes.

2. Methodology

In the study, the survey was used as a method of data collection. Since it was costly, laborious and even unnecessary to reach the entire population in Yozgat province, a random sampling method was used. In 2023, 4360 farmers were registered in the Farmer Registration System (FRS) in the Sarıkaya district of Yozgat, one of the rural areas in Türkiye. Since a significant proportion of the farmers registered in the FRS produced wheat, the sample was selected from farmers who produced wheat. The number of farmers registered in the FRS who grew wheat in Sarıkaya County in 2023 was determined to be 3961. For this purpose, the sample size was determined according to the following formula, which is used when the number of people in the target population is known (Büyüköztürk, 2002).

$n = Nt^2pq/(N - 1)d^2 + pqt^2$ here;

N: Universe; in 2023, the total number of farmers registered with the FRS who produce wheat is 3961,

n: Sample,

p: In Türkiye, the smartphone usage rate is 95%, the internet usage rate is 83% and the rate of active social media usage is 73% (MOBİSAD, 2023). The frequency of the group we are interested in within the population was found by taking the average of these percentages. 95 + 83 + 73 = 251, 251/3 = 83.6%; (p: 0.836),

q: The frequency with which the group we are interested in does not occur in the universe (1-P = 0.164),

t: The Z-table value in the desired confidence interval (95%) is 1.96 and

d: The sample size was calculated to be 201 with an acceptable margin of error (0.05).

The result of the calculations: Although a minimum of 201 samples were sufficient for this formula, the field research reached 211 farmers. The study used descriptive statistics to explain the purposes of ICT use by farmers and the barriers to ICT use in Yozgat Province. Likert-type expressions were used in the study to identify farmers' ICT use purposes and barriers to ICT use. Likert-type items can be interpreted according to whether they are 5 or 7. Since the items in the study are 5-point Likert items, the mean scores of the expressions were evaluated as follows: 1-1.79 as strongly disagree, 1.8–2.59 as disagree, 2.6–3.39 as undecided, 3.4–4.19 as agree and 4.2-5 as strongly agree.

The study was limited to 15 different ICTs. It examined farmers' ownership and use of social media accounts such as WhatsApp, Twitter, Instagram, Facebook and YouTube (Omotayo et al., 2001) and Android-based software (Izuogu et al., 2021) for sharing information, as well as desktop computers, laptops, notebooks, tablets, landline phones, mobile phones, smartphones, televisions, radios, internet and e-mail accounts. The ICT usage score was created by calculating the participants' ICT ownership and usage status as well as the duration of ICT use. If farmers owned these 15 ICTs, it was 1; if they did not own them, it was 0; if farmers used ICTs, it was 1; if they did not use them, it was 0; and the duration of ICT use was expressed in years.

As a result, the ICT score was calculated as = (ICT Ownership + ICT use)*year.

To determine the correlation between the ICT score and the variables, the normal distribution of the variables was examined. The status of the normal distribution was analyzed using the Kolmogorov-Smirnov test. The result of the test showed that the variables were not normally distributed. Spearman's Rho correlation analysis, a non-parametric correlation analysis, was used for variables that were not normally distributed. Jamovi version 2.3.24, an open source statistical program, was used to analyze the data.

The study used structural equation modeling to calculate the factors influencing ICT adoption of ICT by farmers. Kaiser-Meyer-Olkin (KMO) values and Bartlett's sphericity test were used for sampling adequacy in the study. Kaiser (1974) stated that 0.50 should be the lower limit for the KMO test and that if KMO ≤ 0.50, factorization of the data set is not possible (Kaiser 1974). Once the adequacy of the sample had been established, the principal component analysis method and the varimax rotation method were used in the exploratory factor analysis (Kline 1994). The reliability of the determined factors was measured by Cronbach's alpha coefficients. In addition, the structural validity of the factors and the internal consistency were also calculated. To test the convergent validity of the factors, the average variance extracted (AVE > 0.50), composite reliability coefficients (CR > 0.80) and the Heterotrait-Monotrait criterion (HTMT < 0.90) were used for discriminant validity (Franke & Sarstedt, 2019; Hair 2009; Henseler et al., 2015). As a result, the effect coefficients of the factors that have an influence on the ICT usage behavior of farmers were calculated.

3. Results

In this study, a face-to-face survey of 211 farmers was conducted, of which 27 (12.8%) were female and 184 (87.2%) were male. 211 farmers, 87.2% male and 12.8% female, participated in the study. 80.1% of these farmers were married and 19.9% were single. 12.3% of the farmers were between 18 and 30 years old, 15.2% were between 31 and 42 years old and 72.5% were 42 years and older. The average age of the farmers who took part in the study was 53.80 years. US dollars were used to calculate agricultural income. In October 2023, 1 dollar ($) was equivalent to approximately 28 Turkish liras (₺). The average monthly income of farmers was $637. The monthly income of 37.4% of farmers was below $357, 53.1% had a monthly income between $357–1429 and 9.5% had a monthly income of $1430 and above. 1.9% of farmers were illiterate, 5.2% could read and write, 46.9% had an elementary school diploma, 15.2% had a secondary school diploma, 18% had a high school diploma, and 12.8% had a university degree (6.7% had an associate degree, 5.2% had a bachelor's degree; 0.9% had a postgraduate degree) (Table 1).

Table 1
Socio-demographic characteristics of farmers

Variable	Category	Frequency (n)	Percentage (%)
Gender	Female	27	12,8
	Male	184	87,2
Marital status	Single	42	19,9
	Married	169	80,1
Age (average: 53.80)	18–30 years old	26	12,3
	31–42 years old	32	15,2
	42 years old and older	153	72,5
Monthly İncome (average:$637)	< $357	79	37,4
	$357–1429	112	53,1
	>$1430	20	9,5
Education	Illiterate	4	1,9
	Literate	11	5,2
	Elementary school	99	46,9
	Secondary School	32	15,2
	High School	38	18
	University	27	12,8

As a result of the surveys conducted in the Sarıkaya research region, farmers were asked to rank the barriers to ICT adoption in order of importance (Fig. 1). According to the results in Graph 1, the barriers to the use of ICT by wheat farmers in Sarıkaya were: insufficient knowledge, traditional nature of farmers, high cost, lack of time, no one to consult, security problems (viruses, etc.), other farmers do not use it, no access to reliable information, insufficient agricultural extension and consulting services, and not perceived as useful.

The ICT usage purposes of farmers were determined in order of importance as follows: Communication, weather, general information search, current news, information on innovations, social media, news delivery, banking, technical information for agricultural purposes, crop protection, information on support, agricultural machinery, agricultural market information, fertilizer program, e-mail, shopping, watching movies, entertainment (games, etc.), stock market transactions, and ration preparation (Fig. 2).

According to the results of this research conducted in 2023, the internet usage rate of farmers was determined to be 73% and the smartphone usage rate was 74%. According to the data published in Türkiye in 2023, the smartphone usage rate was 95% and the internet usage rate was 83% (MOBİSAD, 2023). It was found that the internet and smartphone usage rates of farmers in Yozgat province were lower than the average in Türkiye. In another study conducted in Türkiye twelve years prior to this study, it was reported that 36% of people in the rural areas of Tokat province, which borders Yozgat province, can use internet technologies (Büyükbay & Gündüz, 2011).

The relationship between ICT use and age, land size, education, farm income and farming experience was interpreted using Spearman's Rho correlation analysis. According to the results of Spearman's Rho correlation analysis, a positive moderate correlation was found between age and television viewing behaviour. A positive weak correlation was found between age and the values for landline, radio and cell phone. A negative correlation was found between age and laptop/notebook, internet, Facebook account, WhatsApp account, Instagram account, Twitter account, YouTube account and e-mail. This means that the values for laptop/notebook, internet, Facebook account, WhatsApp account, Instagram account, Twitter account, YouTube account and e-mail tend to decrease with increasing age. Parallel to the weak negative correlation between age and the values for desktop computers, tablets and smartphones, the use of smartphones was found to decrease with age (Table 2).

A weak positive correlation was found between plot size and the values for laptop/notebook and WhatsApp account. A very weak positive correlation was found between plot size and the values for desktop computer, smartphone, internet, Instagram account and YouTube account. No significant correlation was found between plot size and the use of landline telephones, televisions, cell phones and radio usage (Table 2).

Table 2
Spearman's Rho correlation analysis

ICT Score	Age		Land size		Education		Agricultural income		Agricultural experience	
Desktop computer	-0.253	***	0.153	*	0.385	***	0.174	*	-0.144	*
Laptop/notebook	-0.522	***	0.211	**	0.528	***	0.240	***	-0.384	***
Tablet	-0.349	***	0.098		0.188	**	0.127		-0.154	*
Landline	0.327	***	-0.040		-0.259	***	-0.059		0.292	***
Television	0.559	***	-0.129		-0.352	***	-0.154	*	0.346	***
Radio	0.270	***	-0.086		-0.250	***	-0.145	*	0.119	
Mobile phone	0.366	***	-0.087		-0.148	*	-0.075		0.364	***
Smart phone	-0.375	***	0.188	**	0.293	***	0.197	**	-0.290	***
Internet	-0.448	***	0.186	**	0.369	***	0.215	**	-0.350	***
Facebook account	-0.491	***	0.256	***	0.418	***	0.256	***	-0.373	***
WhatsApp account	-0.440	***	0.204	**	0.334	***	0.221	**	-0.337	***
Instagram account	-0.539	***	0.191	**	0.419	***	0.203	**	-0.424	***
Twitter account	-0.544	***	0.232	***	0.498	***	0.236	***	-0.376	***
YouTube account	-0.462	***	0.195	**	0.416	***	0.169	*	-0.331	***
E-mail	-0.597	***	0.287	***	0.549	***	0.306	***	-0.459	***
Note; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$										

A positive and moderate correlation was found between education and scores for desktop computer, laptop, notebook, smart phone, internet use and Facebook account, WhatsApp account, Instagram account, Twitter account, YouTube account and e-mail. This result indicates that the scores for technology use tend to increase with increasing levels of education. Although there was a very weak positive relationship between education and tablet scores, a weak negative relationship was found between cell phone, landline phone, and television and radio scores.

A weak positive relationship was found between farmers' monthly income and laptop/notebook, Facebook account, Twitter account and e-mail scores. A weak positive relationship was found between income and the values for smartphone, internet, WhatsApp account and Instagram account. Similarly, a very weak positive relationship was found between income and desktop computer and YouTube account

scores, while a very weak negative relationship was found between income and television and radio scores. A moderate negative correlation was found between experience and ratings of Instagram accounts and emails. A weak negative correlation was found between experience and ratings of laptop, notebook, smart phone, internet, Facebook account, WhatsApp account, Twitter account and YouTube account. A very weak negative correlation was found between experience and the scores for desktop computer and tablet. A weak positive correlation was found between experience and the scores for landline, television and cell phone.

According to the results of Spearman's Rho correlation analysis, it can be said that the relationship hypotheses between the use of 15 different ICTs and socio-economic variables are generally significant. Since there is a significant relationship between the use of 15 different ICTs and age, education, agricultural experience, agricultural income and land size, the statistical hypotheses H_1, H_2, H_3, H_4 and H_5 were rejected (Table 2).

The KMO and Bartlett's test were performed to measure the adequacy of the sample. The result of the KMO and Bartlett's Sphericity Test was calculated as 0.920. According to the results of the KMO and Bartlett's test, the sample was found to be adequate ($P < 0.01$). To determine the factors influencing farmers' behavior in adopting ICT, a factor analysis was conducted with 4 items containing statements on attitude, 13 items containing statements on benefits, and 11 items containing statements on behavior. In addition, although perceived ease of use was included in the analysis, it was removed from the analysis due to overlap with behavior. As a result of the factor analysis, 11 out of 28 items were removed and the analysis was completed with 17 items. The 17 items used in the analysis explained 87.53% of the total variance. The behavior factor explained 37.78% of the total variance, the perceived benefit factor explained 34.94% and the attitude factor explained 14.81%.

The average variance extracted (AVE > 0.50) was used to test the convergent validity of the factors, the composite reliability (CR > 0.80) was used to test the composite reliability and the heterotrait-monotrait criteria were used According to test the discriminant validity. The analysis results conducted to test the compound validity of the factors yielded AVE values of 0.650 for perceived benefit, 0.713 for behavior and 0.693 for attitude and met the AVE > 0.50 criteria (Table 3). The Cronbach's alpha value of the behavior factor of the 17-item scale used in the analysis was found to be 0.985, the Cronbach's alpha value of the perceived benefit factor was 0.973 and the Cronbach's alpha value of the attitude factor was 0.839. These values are sufficient and the reliability of the items is quite high. The results of the analysis conducted to test the composite reliability of the factors yielded CR values of 0.968 for the perceived benefit, 0.953 for the behavior and 0.871 for the attitude, thus fulfilling the criteria for CR > 0.80 (Table 3).

Table 3
Factor loadings, reliability and convergent validity

Factors	Items	Factor loadings	CR	AVE	Cronbach's alpha
Behavior	I use a smartphone.	0,942	0,968	0,713	0,985
	I use the internet.	0,940			
	I check the weather forecast.	0,931			
	I spend time on social media.	0,891			
	I use ICT in general.	0,888			
	I use it to get new information and for security.	0,877			
	I use mobile banking.	0,845			
Perceived benefit	Using ICT increases my work performance.	0,892	0,953	0,650	0,973
	Using ICT improves the quality of my work..	0,891			
	The use of ICT enables me to better control my work.	0,877			
	ICT supports important aspects of my work.	0,872			
	The use of ICT increases my productivity.	0,861			
	ICT fulfils the requirements of my work.	0,845			
	Using ICT enables me to do more work than possible.	0,794			
Attitude	Using ICT improves social communication.	0,873	0,871	0,693	0,839
	I believe that the use of ICT will be beneficial.	0,819			
	The use of ICT provides reliable information.	0,805			

The HTMT correlations were calculated for the discriminant validity of the factors (Franke&Sarstedt, 2019; Hair, 2009; Henseler et al., 2015). According to the analysis results, it was found that all HTMT correlation coefficients of perceived benefits and behavior (0.616), behavior and attitude (0.589), and perceived benefits and attitude (0.493) were less than 0.90 and that the model had discriminant validity (Table 3).

The research hypotheses were tested with the help of structural equation models and visualized with a path analysis. As a result of the hypothesis tests, it was found that 41 of farmers' attitudes towards the use of ICT have a positive effect on behavior. According to these results, it can be assumed that applications that improve farmers' attitudes towards the use and adoption of ICT will increase their ICT use. The perceived benefits of ICT use by farmers were found to positively influence their use of these technologies by 42%. Similarly, it was found that the perceived benefits of ICT use by farmers positively influenced their attitude towards using these technologies by 49%. All three statistical hypotheses (H_6, H_7, H_8) were rejected and alternative hypotheses were accepted (Fig. 3).

4. Discussion

Perceived benefits are related to costs and profitability for farmers. Farmers develop attitudes by considering the benefit-loss ratio they receive when adopting a new technology, and their behavior is shaped accordingly. The relationship between perceived benefits and attitudes (Rosli & Saleh, 2024), which is an important source of motivation in ICT adoption (Liu et al., 2010; Prathap et al., 2021), and the fact that attitudes are also important in explaining behavior (Oeldorf-Hirsch & Chen, 2022), have been highlighted in previous studies. It was reported that New Zealand dairy farmers considered and were affected by perceived benefits and ease of use when adopting new technologies (Flett et al., 2004). It was found that the influence of attitude among the factors on behavioral intentions of farmers in Malaysia regarding the use of ICT for agricultural risk management was 43% (Ali et al., 2020). In Türkiye, the use and adoption of agricultural drones by farmers was affected by the farmer's positive attitude towards the technology (Parmaksiz & Cinar, 2023).

It was reported that in Türkiye, the influence of teachers' attitude towards ICT use on intention was 71% and the influence of perceived benefit on attitude was 45% (Turan, 2011). In another study, perceived benefit was found to influence attitude by 44% (Durmuş & Yıldız, 2020). In Erzurum, Türkiye, the influence of perceived benefit on attitudes towards ICT use was found to be 49% (Serçemeli & Kurnaz, 2016). In the study conducted at Uşak University, it was calculated that the effect of perceived benefit on attitude was 40% (Şahin & Alkaya, 2017). As a result of the analysis conducted in Nevşehir province, it was determined that the effect of perceived benefit on the attitude towards the use of mobile payment is 64% (Seyhan & Bozpolat, 2019). In a study conducted, it was emphasised that the use of ICT improves farmers' production processes (Tologbonse et al., 2010) and that there is a positive correlation between the perceived benefits of using ICT and attitudes in general (Rosli & Saleh, 2024). The results of this study, conducted in rural areas in Yozgat province, were consistent with previous studies.

5. Conclusion and recommendations

Although the adoption of applications related to the development of information and communication technologies, which are rapidly changing agricultural production techniques, can bring significant benefits to a certain group of farmers, it is not easy for a certain group to adopt these technologies. At first glance, information and communication technologies can be seen as an advantage for rural areas

and a new way to bridge the development gap between regions. However, if farmers are not able to utilize these technologies, it is more likely that inequalities between regions will increase to dramatic levels. According to the results of this research, the first obstacle for farmers to use ICT is the lack of necessary knowledge and skills. Interestingly, the second barrier is that the traditional structures of farmers themselves, i.e. their habits, are an obstacle to the use of these technologies. Obstacles such as high costs or time pressure can be seen as more concrete, independent of the structure of the community and as clear reasons. It is clear that in order to make the use of ICT in rural areas widespread and effective, it is necessary to focus primarily on the development of knowledge and skills related to the use of these technologies. In addition, solutions can be developed to harmonize ICT, which is an element of material culture, with elements of spiritual culture in order to overcome the barrier of tradition. In this regard, developing farmers' attitudes towards the use and adoption of ICTs is a long-term but important strategy.

Based on the existing studies in the literature, it can be assumed that attitudes and perceived benefits influence behavior and that the benefits of ICT should therefore be explained to farmers. However, if this assumption is not confirmed, it is unfounded and unsubstantiated. The point to consider in the use of ICT is the relationship between attitude and perceived benefits and socio-economic variables. This is because for the benefits to be perceived, the farmer must have a certain level of education and a certain age. Since illiterate people are not able to pay their bills or do their banking online via ICT, they go to urban centers. This also means a loss of work and time for farmers. The use of ICT also increases the work efficiency of farmers and saves them time. The need for labor in rural areas (Oruç & Çağlar, 2022) can be met by increasing the use of ICT in agriculture. Considering all this, socio-economic factors such as the age of the farmer, land size, farming experience and the purpose of ICT use should be taken into account when adopting ICT.

The tendency to obtain information from these technologies in agricultural subjects, which are among the objectives of using ICT, can be considered important. The study conducted by Büyükbay and Gündüz (2011) revealed that this tendency was quite low during the period in which the study was conducted. The results of this research showed that there was a negative correlation between age and the use of laptop, internet, Facebook, WhatsApp, Instagram, Twitter, YouTube account and e-mail accounts, which is consistent with the information that young farmers adopt innovations faster. Social media monitoring, which requires social skills as well as telephone, computer and internet use, is a complex area for older farmers. Agricultural extension, defined as “simplifying messages for ordinary people”, and the use of ICT should be made simple and understandable within agricultural extension services at the farmer level. Technology companies, agricultural engineers, agricultural advisors, etc. should increase their extension activities and provide practical training on ICT use. Information campaigns and training activities should focus primarily on the economic benefits of ICT use, reduction of production costs, time savings and reduction of physical workload.

Declarations

Author Contribution

Authors contributions: In this article, data was collected by Hilal Esra Kılıç, analysis and article writing were done by Güngör Karakaş.

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Figures

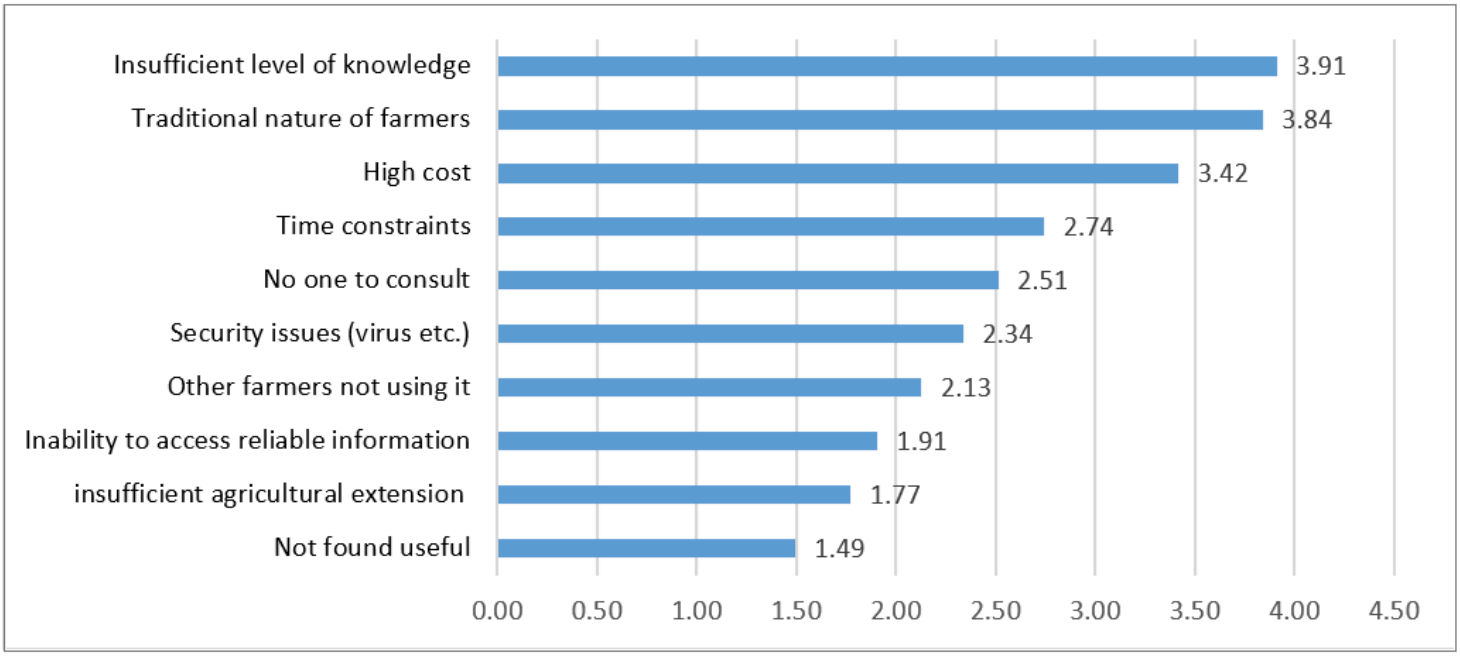


Figure 1

Barriers to farmers' use of ICT by farmers

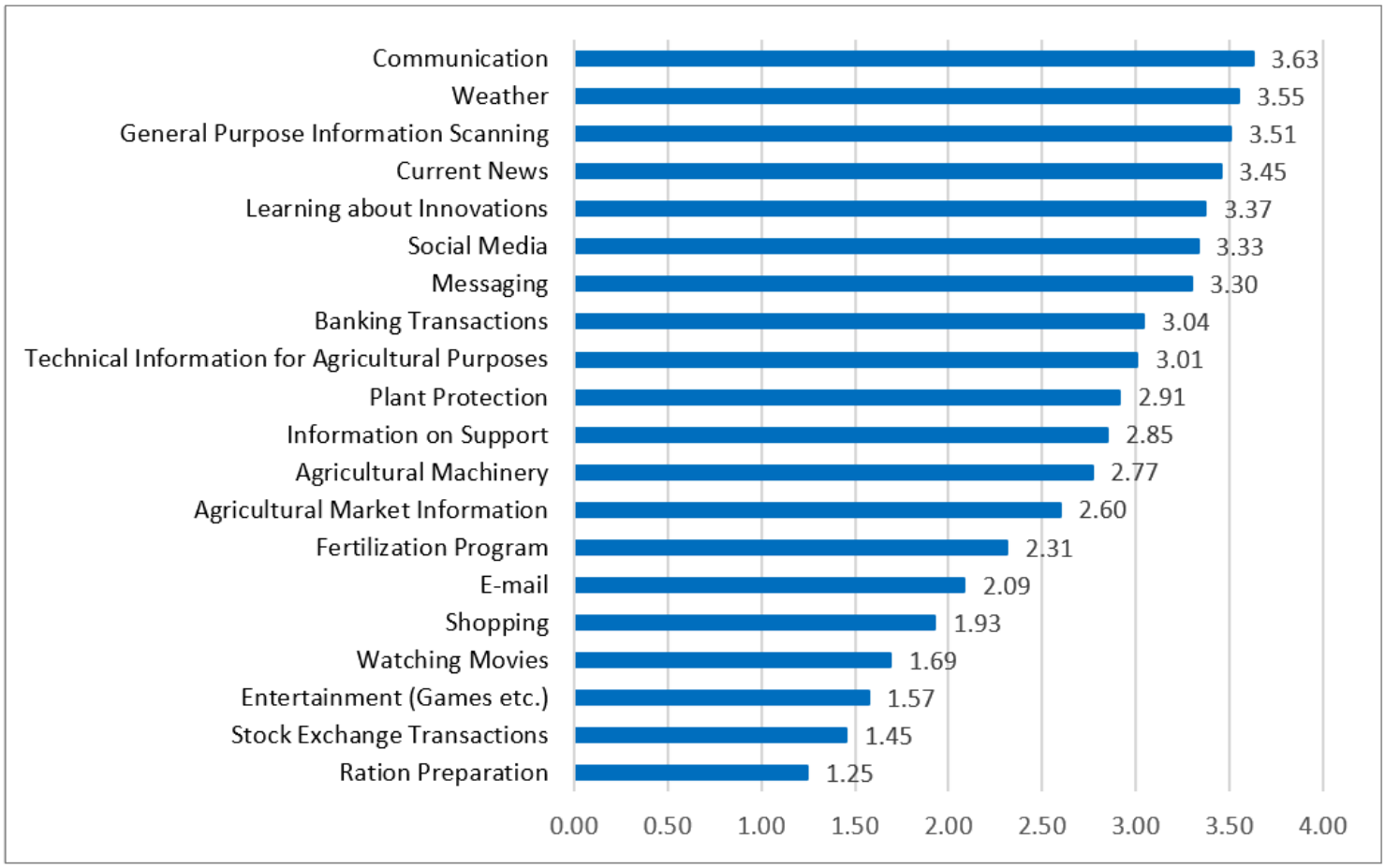


Figure 2

Farmers' ICT Usage Purposes

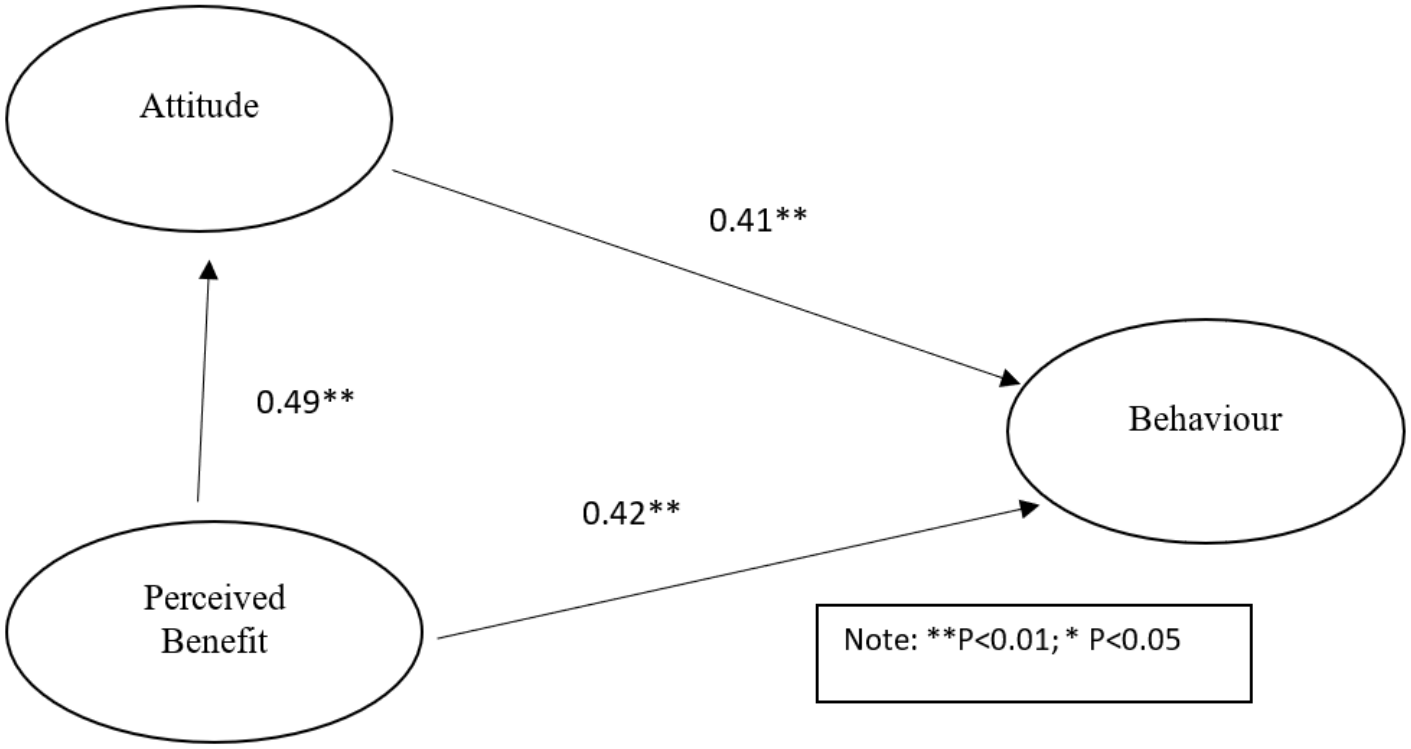


Figure 3

Path analysis