Factors Affecting ICT Adoption in Rural Area: A Case Study of Rural users in Iran

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ABSTRACT

Newly emerging technologies such as information technology are priority areas for public science and technology funding, and in recent years significant progress has been made in the application of these new technologies. Since the modernization era, the accessibility to rural ICT centers has been the main challenge. Adoption of new technologies can improve efficiency in agricultural sector. This study examines the factors that affect the ICT adoption by rural users in Kermanshah Province. The sample included 110 individuals, who were selected by random sampling method. Survey method was used, and data was analyzed by correlation as well as multiple regression techniques. Based on the result, households' attitudes towards ICT, compatibility and contact with agricultural extension agent are significant determinants for ICT adoption. It is assumed that the adoption of ICT within a rural center would affect the general ICT adoption upon which further inquiries is recommended.

KEY WORDS: ICT, Adoption, Agricultural Sector, Iran

INTRODUCTION

Over the last decades global information society is emerged. Accelerating information flow, communication and the rapid development of technology is provided a new phenomenon that named Information and Communication Technologies (ICT) (Koutsouris,2010).It affect different fields such as medicine, education, agriculture and business and provided competitive, social and political opportunities for users(Usluel *et al*.,2008) and also note the persistence of the so-called 'digital divide' (UN, 2006).

It is readily accepted that increased information flow has a positive effect on the agricultural sector (Adamides *et al*., 2013). However, collecting and disseminating information is often difficult and costly. Information technologies (IT) offer the ability to increase the amount of information provided to all participants in the agricultural sector and to decrease the cost of disseminating the information (Cragg, 1996).

The agricultural sector plays an important role in the Iranian economy. This sector accounted for 14 percent of GDP and 21 percent of the economically active population (CBI, 2007). Newly emerging technologies such as information technology are priority areas for public science and technology funding, and in recent years significant progress has been made in the application of these new technologies. Iran's entrance into the Internet was then spearheaded by IPM (Institute for studies in theoretical Physics and Mathematics) and since 1995 over than 6000 ICT centers were developed in Iran's rural(Abbasi *et al*.,2008). ICT centers attract different groups within rural communities and create a forum for unprivileged rural settlers to learn about and to use computer and internet. Thus, the importance of information and communication technologies (ICT) to rural communities cannot be over-emphasized (Moghaddam and Khatoon-Abadi, 2013).

Majority of factors affecting adoption of ICTs are generic in nature. For instance cost effectiveness and speed of information transfer, organizational characteristics like business size, system characteristics like availability and access to ICT services, and internal and external characteristics of the business household like education, past experience in using ICTs, attitude towards ICTs, business objectives and incomes among others (Windrum and Berranger, 2002; Dholakia and Kshetri, 2004). Sekabira *et al*.,(2012) argued that Farmers with

knowledge of ICT groups and those thinking that ICTs benefited agriculture were more likely adopters of ICT-based market information services. Also family size and land farmed influenced farmers' adoption, whereas age, trading experience, family size and monthly expenses influenced traders' adoption. Jacobs and Herselman (2006) said that the perceived lack of need for ICTs by smallholder farmers is responsible for farmers' failure to adopt ICTs and their services. Khalil Moghaddam and Khatoon-Abadi(2013) found that the existence of ICT center itself, various funding sources, individual and social factors, as well as households' informative & communicative reinforced the adoption of ICT. Cheong (2002), studied of internet adoption in Macao. The results showed that the use of media, assessment of media credibility, perceived value of the Internet, and demographic factors, annual households' income, occupation and educational levels had affected the amount of ICT application as indices for determining adoption of ICT. Thrane(2003) found that there were correlations between adoption and the ICT characteristics, existence of willingness among users and also access of facilities. Nyamba and Mlozi(2012) identified factors influencing use of mobile phones in communicating agricultural information to include sex, education level, incomes, mobile phone ownership, type of farming practiced, type of agricultural information needed, and network coverage. Aleke *et al*.,(2011) by studying ICT adoption in small-scale agribusinesses operating in Southeast Nigeria have shown that active social networks and government support ensured technological successful diffusion.
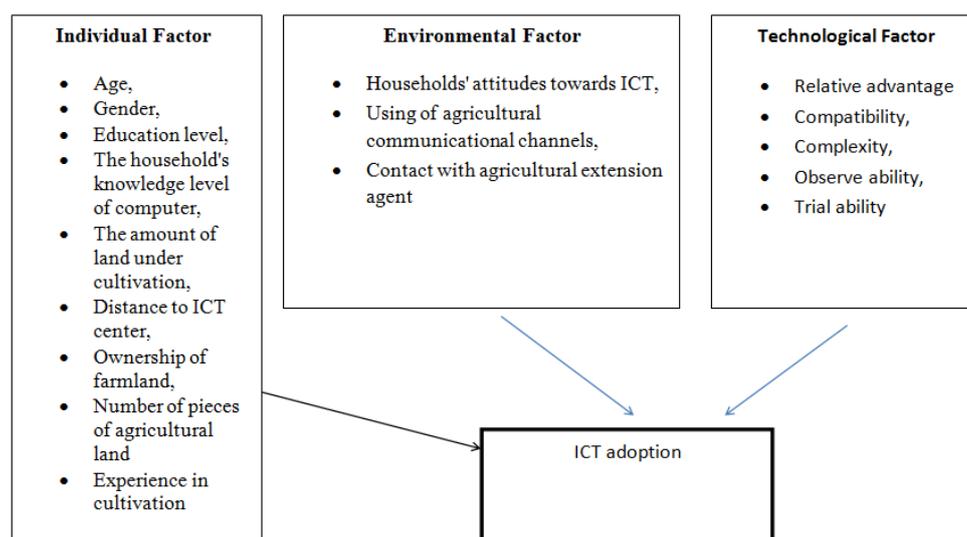
Numerous studies (Mustonen-Ollila and Lyytinen, 2003; Wainwright and Waring, 2007; Aleke *et al*.,2011) have argued, that traditional diffusion of technology innovation theories, which were based on earlier work by Rogers (1962) articulates the process of ICT adoption. Rogers (1962) mentions that the rate of adoption is partially influenced by perceived attributes named as innovation characteristics which are relative advantage, compatibility, trialability, complexity, and observe ability. The relative advantage, compatibility, trial ability, observe ability of an innovation, as perceived by members of a social system, are positively related to its rate of adoption; on the other hand the complexity of an innovation, as perceived by members of a social system, is negatively related to its rate of adoption(Usluel *et al*,2008). Another model involves Technology Accepted Model (TAM) explained that attitudes and behavioral intensions towards technology may affect the usage of ICT may affect the usage of technology (Davis, 1989). Therefore according this model two kind of attitude that is the perception of usefulness, and the perception of ease of use is a major driver for adoption of ICT (Mustonen-Ollila and Lyytinen, 2003).The third theory considered is the social network theory (SNT).This theory suggests that social networks including relationships and knowledge networks can enhance socialized and facilitate decision-making of farmers (Aleke *et al*., 2011). Furthermore, based on Rural Area Technology Acceptance and Diffusion of Innovation Model (RuTADIM) proposed by Lu and Swatman (2009) is the only model focusing on rural context. This model was developed to investigate acceptance mobile phone and the likely diffusion of a project called MobiCert in rural areas of south Australia. RuTADIM influenced by the TAM. It explains three factors (external, individual, and technological) that affect technological adoption.Rashid and Colleague's model (2001) which was presented for e-commerce technology adoption by New Zealand SMEs at 2001. In this model 4 factors (technological, organizational, environmental and individual) are identified as influential factors of ICT adoption.

In this paper, we discussed the conceptual model (see figure 1) adopted, and explained the rational for its choice. Contrasting to Rogers' adoption theory, Rashid *et al*. in their study have focused on the technical factors (e.g., relative advantage, complexity, compatibility,cost, and observe ability).But organizational factor was omitted because it refers ICT adoption in SMEs. According to TAM and SNT behavioral attributes and communication channels have considered as factors affecting ICT adoption. On the other hand, based on, the adopted model by Lu and Swatman (2009) the external factors impacted on IT adoption: such as facilitating conditions and Tech-service promotion. In this study, access to ICT centers has been selected as effective factor. Moghaddam and Khatoon-Abadi (2013) presented an adapted model for ICT adoption in Iran. Three factors have explained in this model including individual, contextual (involving social, economic and information and communicative characteristics of users' households), and technological aspects. Based on a combined exploration of models and case studied are different for an attractive conceptualization.The conceptualized model to be used in this paper (Fig1) has categorized the influential factors into: three sub category including individual factor (involving age, gender, education level, the household's knowledge level of computer, the amount of land under cultivation, distance to ICT center, ownership of farmland, number of pieces of agricultural land, experience in cultivation), environmental factor(involving households' attitudes towards ICT, using of agricultural communicational channels, contact with agricultural extension agent), technological factor(relative advantage, compatibility, complexity, observe ability, trial ability). Therefore the aim of this study is to seek what factors impact on ICT adoption foe rural users. This helps to offer a better understanding of influential factors on ICT adoption in rural environment.

Methods:

The statistical population included 3000 rural users in Kermanshah Province who use ICT center once a week at least. The random sampling method was used to provide context for generalizing data. The sample size

determined by Cochran's formula is 110. A questionnaire based on Likert scale was designed to collected data. The similar studies which have been mentioned in the literature have used quantitative methods to determine and prioritize the factors affecting adoption of ICT. The interpretative statistics has been used to determine the influencing extent of the parameters. ICT adoption as the dependent variable was measured by 5 items (including the amount of change in using of fertilizers after using of ICT, the amount of increasing in users' skills for agricultural tasks, the amount of increasing in users' abilities for agricultural tasks, searching agricultural information through computer, Increasing contact with agricultural research centers after using of ICT) and using the Likert scale(from 0:nothing to 5:very high). Individual factor as an independent variable included age(years),gender(men, female),educational level(illiterate, primary school, high school, diploma, bachelors', master's), knowledge level of computer by using the Likert scale(from 0:nothing to 5:very high), number of members with the knowledge of computer, The amount of land under cultivation(hectare), Distance to ICT center(Kilometers), Number of pieces of agricultural land, experience in cultivation(years).The second independent variable is environmental factor included Households' attitudes towards ICT by Likert scale(from 1:very low to 5: very high), Using of agricultural communicational channels ICT by Likert scale(from 1:very low to 5: very high), Contact with agricultural extension agent(once a year, twice a year, three times a year, more than three times). technological factor as the third independent variable included relative advantage, compatibility, complexity, observe ability, trial ability that measured by Likert scale (from 0:nothing to 5:very high). The analyses: statistically it is justified to use the analytical methods and tests for semi quantitative variables as similar to quantitative variables. Also the different correlation analyses along with the multiple regression with stepwise method were used for each variable couples depending on the type of data (Kalantari, 2012).Content and face validity were conducted by panels of development communication and agricultural experts who supplied some structuring revisions on the instrument. A pretest was conducted on 30 rural users of other ICT centers to determine the reliability of the questionnaire. The reliability was estimated by Cronbach's alpha coefficient (α= ./87), which was acceptable. The data was analyzed by Spss/Win(Version 16) software.

Individual Factor
- Age,
- Gender,
- Education level,
- The household's knowledge level of computer,
- The amount of land under cultivation,
- Distance to ICT center,
- Ownership of farmland,
- Number of pieces of agricultural land
- Experience in cultivation

Environmental Factor
- Households' attitudes towards ICT,
- Using of agricultural communicational channels,
- Contact with agricultural extension agent

Technological Factor
- Relative advantage
- Compatibility,
- Complexity,
- Observe ability,
- Trial ability

ICT adoption

Fig. 1: Conceptual model of ICT adoption for rural users.

Results:
Descriptive data:

41.3% of rural users were young, aged between 31 to 41 years old and 93.1% of users were men. Also 50% of the users was with primary educational level, whereas higher educational level (diploma and higher of diploma) was 21.4% in total.69% of users stated that they have knowledge of computer. The amount of land holding 60% of users was between5 to 10hectare. Work experience 31.3% of users was between 20 to 30 years.60% of users responded that distance to ICT center was between 2 to 10 kilometers.69% of users were Ownership of farmland. 75.1% of users responded that number of pieces of their agricultural land were between 2 to 4 pieces.

Correlation Analysis:

To test the relationship between variables, correlation analysis was done. Table 1 illustrate the correlation between the key variables. There is a relationship between ICT adoption and, the entire individual factor, excluding two variables including gender and ownership of farmland. According to Table 1, there is a

significant relationship between technological factor (including relative advantage and compatibility) and ICT adoption. With regard to the correlation analysis, there is a relationship between: the variable of households' attitudes towards ICT, using of agricultural communicational channels, contact with agricultural extension agent, and ICT adoption. Therefore, there is a relationship between environmental factor and ICT adoption.

Table 1: Correlation between the variables and ICT adoption.

Factors	Variable	The correlation value	Sig
Individual Factor	Age	-0/276**	0/003
	Education level	0/249**	0/007
	The household's knowledge level of computer	0/248**	0/007
	The amount of land under cultivation	0/360**	0/000
	Distance to ICT center	-0/526*	0/017
	Number of pieces of agricultural land	0/474**	0/000
	Experience in cultivation	-0/206*	0/209
Technological Factor	Relative advantage	0/204*	0/028
	Compatibility	0/384**	0/000
Environmental Factor	Households' attitudes towards ICT	0/829**	0/000
	Using of agricultural communicational channels	0/222*	0/019
	Contact with agricultural extension agent	0/504**	0/000

** 5% significance level, ***** 1% significance level.

Multiple variable analyses:

A regression model was applied to understand the relationship between the independent variables and ICT adoption. The result of the model are represented in Table 2. As Table 2 shows, factors that impact on ICT adoption are "households' attitudes towards ICT", "compatibility", and "contact with agricultural extension agent". According to the table, the adjusted R^2 in the model shows that the independent variables can explain about 0/70 percent of the changes in the dependent variable (ICT adoption).

The result shows that the attitudes towards ICT adoption. The effect is positive and significant at 99% confidence level (ß=0/562, Sig=0.01). Hence, improving attitudes towards ICT adoption can determine 0/562 increase in ICT adoption. Beta coefficient shows that this effect is the strongest effect among the variables. Accordingly, increasing in use of ICT by rural user that had positive attitude towards new technologies is likely to be increased by 0/562. Furthermore, compatibility with ICT has had positive impacts on ICT adoption(ß=0/562, Sig=0.01). The effect is positive. Therefore, when compatibility with technology increase, ICT adoption increase too. Finally, Contact with agricultural extension agent affects ICT adoption positively (ß=0/233, Sig=0.01). Therefore, those users that more link and contact with agricultural extension agents try to increase their ICT adoption. The significant of a high amount of R^2 of regression model (Table 3) as well as proving the significant of F, imply the goodness of fit of the regression model of research.

Table 2: Multiple regression analysis to identify the effective factors on ICT adoption.

Variable	Beta	S.E	B	Sig
Households' attitudes towards ICT	0/562	4/03	0/890	0/000
Compatibility	0/266	3/81	0/329	0/000
Contact with agricultural extension agent	0/233	3/56	0/631	0/000

Table 3: The result of the stepwise multiple regression model assessment to identify the ICT adoption's effective factors.

R	R2	Adjusted R2	F	Sig.F
0/835	0/698	0/689	80/066	0/000

Discussion and Recommendation:

Summarizing, through the regression analysis, it appears that households' attitudes towards ICT, compatibility and contact with agricultural extension agent, are factors that significantly influence the amount of ICT adoption. About the adoption of ICT, it appears that it is significantly affected by households' attitudes, compatibility as well as contact with agricultural extension agent. It seems that household with the most positive attitude towards ICT adoption was those who interpreted IT as an effective tool in transforming agriculture operations. It can be recommended that field visits be organized for dissemination of ICT among rural people. It is because through different training visits, people learn about the successful centers in terms of the advantages, as well as the accountability of ICT and finally positive attitude toward ICT increases among farmers.

Also, compatibility as one of technological factors was influential on ICT adoption. Because a faster rate of adoption occurs when an adopter perceives an innovation as meeting the needs of the client and being compatible with existing beliefs, experience and needs of potential adopters. It indicates that an innovation is more likely to be adopted if it is compatible with individual job responsibility and value system.

This study shows the impact of the contact with agricultural extension agent on adoption process. It can be recommended that the successful ICT introduction and use depends on extension organizations. They can focus

on the informational needs of their clients and deliver new technologies. It indicates that extension organizations can provide access to new technologies for low-resources smallholders.

Moreover, the successful ICT introduction and use is multidimensional and thus depends on the individual factor. It appears that age, education and knowledge level of ICT, the amount of land under cultivation, distance to ICT center, number of pieces of agricultural land, experience in cultivation are factors that significantly influence the adoption of ICT by farmers. In general, younger and more educated farmers with more land under cultivation, who have access to ICT centers in rural, have a greater tendency of using ICTs. Not only the young people's educational level, but also their access to communication media provided a fruitful context in rural and had led them to adopt to put into practice their knowledge of the new technology. Educated farmers, particularly those who have fulfilled tertiary education are more exposed to new technologies and by extension they adopt and use them in their farms. It suggests that these courses can deliver to farmers by public and private institutions, even by courses organized by extension organizations. Finally it is assumed that the adoption of ICT within a rural center would affect the general ICT adoption upon which further inquiries is recommended.

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