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Encouraging and Discouraging Factors in Application of Information and Communication Technologies in Agricultural Extension in Isfahan Province of Iran

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Abstract

The benefits of Information and Communication Technologies (ICTs) for agricultural extension purposes and activities are obvious. The main objective of this article is to identify encouraging and discouraging factors in application of ICTs in agricultural extension in Isfahan province of Iran. This study investigated areas of ICTs application by Extension Workers (EWs), too. The research design was a descriptive method. The population includes 320 Isfahan province EWs that 200 person were choose by census and stratified sampling methods. In our contribution we focused on finding. Face and content validity of the questionnaire was established using a panel of experts consisting of faculty members in the Departments of Agricultural Education and Extension, Tarbiat Modares University and extension officers in the Isfahan Province Agricultural Jihad Organization. Cronbach's Alpha to estimate the reliability of the instrument was among 82.6 - 87.8. On the ranking of principal areas of applying ICTs by EWs in extension "typing letters/report", and "prepare and protect file on process basic agricultural and rural information", and "access to the latest agricultural news and information", had most usage. The main result of the study revealed that the EWs in the study approximately use ICT quite a bit. For EWs ICT Encouraging Items Principal Factor Analysis extracted four factors which accounted for 76.24% of the total variance. And Factor analysis for EWs ICT discouraging Items extracted six factors which accounted for 62.84% of the total variance.

Keywords:
Agricultural Extension, Information and Communication Technologies (ICTs), Encouraging and Discouraging Factors, Extension Workers (EWs), ICT Application, Iran

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INTRODUCTION

In today's world, Information and Communication Technology (ICT) is significantly important in an ever increasing speed and precision in different economic and social tasks. Particularly, in many organizations having several branches scattered in different physical locations, or organizations responsible for doing multiple and versatile tasks. ICT systems are able to solve the problems of such organizations. Experience from organizations across the world show that ICT easily solves many problems related to information orientated organizations, and it also provides powerful tools in doing so (madadi *et al.*, 2012). The benefits of ICT for agricultural extension purposes and activities are obvious. ICT can be used to increase the effectiveness and efficiency of extension work (Akpabio *et al.*, 2007). ICT use enables extension officers to play complimentary roles of accessing and transferring relevant information to farmers (Meera *et al.*, 2004) and also helps farmers to utilize such information to solve pressing problems (Klink in Leeuwis, 2004).

Gelb and Offer (2006) reported that adoption of ICT in rural areas for agricultural purposes is a unique challenge and has long been of specific public concern with regional, national and international strategic significance. Studies in recent years have shown more and more that the ownership and use of a computer as well as access to the Internet have become rather the rule than the exception (Doluschitz and Pape, 2002; and Nass, 2001). ICT adoption in agriculture has increased considerably over the last several years. (Rosskopf and Wagner, 2003), but In spite of an obviously increasing usage of hardware, usage of ICT still faces many obstacles. From a scientific views point the reasons for this discrepancy have started to be examined (Gelb *et al.*, 2001). In Iran, it becomes necessary to investigate factors affecting ICT application by EWs.

Therefore, some studies did to recognize main areas, factors affecting of applying ICT in agriculture and agricultural extension system (Falaki, 2005; Fallah, 2006; Hedjazi *et al*., 2006; Annor- Frempong *et al.,* 2006; Meera *et al.*, 2004; Bheenick and Brizmohan, 2003; Maru and, 2003; and Chieochan *et al.*, 2000).

Shabanali Fami *et al.*, (2009) in their study investigated areas for potential application of ICTs in the agricultural extension system of Iran (2009). The findings revealed that six factors/components containing 32 variables determined about 68.91% of the variations in the areas of application. The six factors were Management of documentation and preparation of extension information (14.88% of variance), Planning and implementation of extension education programs (13.6%), Professional empowerment of extension agents (10.8%), Expansion of intra-organizational relationships (10.27%), Facilitation of organizational processes (9.7%), and improving communication through e-mail services (9.64%).

Saheed *et al.*, (2013) in assessment of use of selected ICTs for extension service delivery, indicated constraints of ICTs application for extension service delivery such as: high illiteracy level among farmers, high cost of procurement of ICTs, cost of maintenance of ICTs, negligence on the part of the farmers and inadequate technological know-how. It was found that the Internet was the most constrained ICT, followed by the use of CD-ROM technology, and multimedia projector. Finally, they ranked severity of constraint against various ICTs by extension agent.

Faghiharam *et al.*, (2012) in their study for assessment of socio- psycho factors on use of ICT showed nine variables that affect the application of ICT. These variables clarify 84 percent of the dependent variable's variance totally. Computer competence, computer self–efficiency, management support and perceived ease of use of computer were recognized as strong predictors of ICT application.

In another study, Patil *et al*., (2008) at investigate for adoption of ICT for Indian agriculture, asked the factors limiting the use of ICT by farmers, extension working with farmers, and research working with farmers. An evaluation of the Indian scene suggests that market information and weather updates are of prime interest; illiteracy, cost and lack of awareness are the major adoption constraints. Human capital enhancement was understood to be the main remedial factor to change the low rate of ICT adoption and its effectiveness.

Akpabio *et al*., (2007) in their study focused

on constraints affecting the utilization of Information and Communication Technologies (ICTs) for agricultural extension activities by Agricultural Extension Officers in Nigeria's Niger Delta Region. Findings revealed important specific constraints to include: poor ICT infrastructure development, high cost of broadcast equipment, high charges for radio/television presentations, high cost of access/interconnectivity and electricity power problems. The use of Factor Analysis aided to crystallize identified constraints into three factors of 'poor enabling environment', 'lack of accesses and 'dissemination of unrelated information'. Against the background of several national government initiatives to develop the infrastructure base of the country, recommendations are proffered to ameliorate ICT use constraints.

Another survey was carried out to identify immediate applications and constraints to the application of IT in extension in Mauritius. All extension officers recognize the use of computers in their work as a tool to store, process and retrieve information, with a range of objectives more pertinent to the field of extension and the main issues raised by farmers. The crop extension officers in this study would presently use computers to access information on new technology and research findings, especially on pest and disease control. Sugarcane and livestock extension officers see the immediate applications of computers in their work as accessing a database on the individual farmers and as a means of speeding up the flow of ICT. Also extension officers ranked the constraints that might hinder the application of IT in extension. Training of extension officers constitutes the most important constraint to be overcome before IT can be applied in extension. Other constraints include lack of familiarity of extension officers with computer and lack of infrastructure. Finally this study concluded that, the institutions will have to devise Information Technology strategies to overcome current obstacles dealing with issues such as training, infrastructure, appropriate human resources, and the adoption of a policy on information sharing (Bheenick and Brizmohan, 2003).

Several studies have endorsed the some barriers of ICT application in education. BECTA (British Educational Communications and Technology Agency) in its report (2004), categorized barriers to ICT use into two groups: external barriers and internal barriers. External barriers included: lack of access to resources; lack of time; lack of effective training; technical problems; whereas internal barriers included: lack of confidence; resistance to change and negative attitudes; no perception of benefits. Findings showed that although students and teachers in their study had good ICT skills in terms of their own personal use, they were unable to transfer these skills to using ICT in the classroom.

A recent study in Singapore (Teo, 2006) based on the observations of ICT-mediated lessons and face-to-face interviews with teachers, ICT heads-of-department and school principals, identified six major barriers to teacher ICT-integration: (a) inadequate appointment of technical support staff, (b) inadequate appointment and training of student ICT helpers, (c) lack of sufficient time for teachers to prepare for ICT-mediated lessons, (d) insufficient collaboration among teachers in preparing ICT-mediated lessons, (e) lack of support provided by school leaders in addressing teachers' ICT concerns, and (f) insufficient training, demonstrations or advice for teachers on how to incorporate ICT into classroom instruction.

Another studies indicated barriers to use ICT among farmers. In one study all respondents (farmers and non-farmers) were asked to identify factors limiting the use of ICT by farmers. While the scientists saw the cost of technology and the lack of user friendliness as the main problems, the participants of this study thought that lack of training and failure to understand the possible benefits were the greatest impediments. Both farmers and non-farmers from agriculture-related areas agreed on that point (Rosskopf and Wagner, 2003). Mc Carthy (2003) in a sample survey of 35 Teargas beef farmers also found that lack of computer skills is still a major problem for farmers. 37% of respondents identified lack of computer skills as the most significant problem with using a computer on the farm. 23% felt the major problem was that too much work was involved to get a benefit, followed by 20% who identified security fears as being the major problem. Another research is: Gelb and Parker, 2006.

Morris (2002) in a sample survey of 162 ICMSA members found that the lack of appropriate training (28%) was perceived to be the most common barrier inhibiting present/future Internet use. Second was the cost of the Internet connection (28%), third was the cost of the computer (14%), fourth was finding time to use (13%), fifth was privacy (12%), sixth was security (4%) and last was other (1%).

Maru (2003) in his paper "ICT Use in Agricultural Extension in India" indicated the key issues affecting ICT Initiatives in Agriculture and particularly in dissemination of marketing information are:

1. The lack of reliable connectivity in rural areas
2. The sheer lack of purchasing power in the rural segment, which makes it necessary to find sponsors (govt, co-operative, private sector companies) who benefit by way of advertising, goodwill creation or fulfillment of certain objectives.
3. The time element in establishing e-governance services in districts, which has a cascading impact on investment cost.
4. The need to have high usage of graphics and voice-overs (less confidence with computers, low literacy levels) in content.

This study was therefore conceived to identify perceived encouraging and discouraging factors in application of ICT in agricultural extension and principle areas of application in Isfahan Province of Iran.

Purpose and objectives

The overall purpose of this study was to investigate and analyze the factors encouraging and discouraging in application of information and communication technologies (ICT) in agricultural extension in Isfahan Province of Iran as perceived by extension workers (EWs). The specific objectives of the study were to:

1. Describe job and demographic characteristics of EWs;
2. Determine application of ICT in agricultural extension by EWs;
3. Identify factors encouraging and discouraging to the use of ICT by EWs;
4. Determine relationship between encouraging (four factors) and discouraging (seven factors) and application of ICT by EWs.

MATERIALS AND METHODS

This study used a descriptive-co relational design. The population for the study consisted of all extension workers (N = 320) at the extension organization, Isfahan Province, Iran among whom 42 individuals were located in the agricultural organization of Isfahan province and the branch of the county management (N=70), were studied by census. For the selection of the required sample of the centers of providing agricultural services, the appropriate stratified sampling method was used that 200 answered a self-completion questionnaire were returned, totally. Factors encouraging and discouraging the application of ICT by EWs in agricultural extension were assessed using an instrument. The instrument was divided into four parts; part one was designed to assess ICT application among EWS in their job, using 21 statements. The 21 statements were measured on a four-point, Likert-type scale, that ranged from; 1 = "Not at All" 2 = "Slightly" 3 = "Quite a Bit" and 4 = "Very Much."

Parts two and three were measured factors encouraging and discouraging ICT adoption in agricultural extension by extension worker. The 31 and 30 statements were measured on a four-point type scale respectively. The scale ranged from; 1 = "Not at All" 2 = "Somewhat" 3 = "Slightly" and 4 = "Very Much." Finally, part four was designed to identify demographic and job's characteristics. The following were demographic and job's characteristics assessed: gender, age, highest education completed major area of study, work experience, current work location, and employment status. The instrument was assessed for content and face validity by a panel of experts consisting of faculty members in the Departments of Agricultural Education and Extension, Tarbiat Modares University and extension officers in the Isfahan Province Agricultural Jihad Organization. The instrument was pilot tested using extension worker (N = 30) at Isfahan Province who were not included in the study. Minor changes were made to improve the clarity and readability of the instrument. Cronbach's alpha, an internal consistency measure, was used to estimate the reliability. The reliability coefficient for part one, two and three of the instrument were among 82.6 - 87.8. respec-

tively. Each of these is considered to be very acceptable level of reliability for research purposes. Data were analyzed by SPSS software 16 and using frequencies, percentages, means, and standard deviation. Descriptive statistics and Pearson Moment Correlation tests were computed to describe the relationships. The scale developed by Davis (1971) was used to describe the magnitude of the relationships.

Factor analysis was computed to group variables for encouraging and discouraging factors for ease of presentation and discussion purposes. The details of factor analysis for encouraging and discouraging factors are shown in Tables (3 and 4).

RESULTS

Objective 1: Demographic Profile of Respondents

Majorities (87%) of the respondents were male (see Table 1). Age of respondents was distributing evenly among the three groups (23.5% under 30 years; 36.0% between 31-40 years and 35.0 % between 41-50 years). Three of five respondents (59%) had completed Bachelor of

Table1: Frequency and Percentage for Demographic and Job's Characteristics.

Demographics Profile		f	%
Gender			
Male		154	87.0
Female		23	13.0
	Total	177	100.0
Age*			
30 years and less		42	23.5
31 – 40 years		64	35.8
41 – 50 years		63	35.2
51 years and more		10	5.6
	Total	179	100.0
Highest education completed			
High school diploma		18	10.2
Bachelors of art		33	18.6
Bachelors of science		104	58.8
Masters of science		22	12.4
	Total	177	100.0
Major area of study			
Extension and education		17	9.5
Agronomy		50	27.9
Animal science		21	11.7
Other agricultural majors		64	35.8
Not related to agricultural major		27	15.1
	Total	179	100.0
Work experience in agricultural extension**			
5 years and less		75	41.2
6 – 15 years		68	37.4
16 years and more		39	21.4
	Total	182	100.0
Work location			
Provincial level		36	19.7
District (Shahrestan) level		51	27.9
County (Dehestan) level		96	52.5
	Total	183	100.0
Employment			
Tenured		87	48.9
Tenured track		91	51.1
	Total	178	100.0

*Mean of age = 37.83, SD = 8.16 and range between 23 to 55 years old.
** Mean of work experience = 9.42, SD = 7.57 and range between 1 to 29 years of experience.

Table 2: ICT Application by EWs in their Job

ICT Application	n	Mean*	S.D	Rank
Typing letters/reports	183	3.24	0.92	1
Prepare and protect file on process basic agricultural and rural information	181	2.89	0.87	2
Access to the latest agricultural news and information	183	3.00	0.97	3
Upgrade EWs' professional competencies	183	2.70	0.92	4
Prepare and present published brochure needed at the local level	183	2.83	0.98	5
Improve the administrative information activities at regional level	183	2.67	0.93	6
Record and exchange of information in regard for extension centers	182	2.84	0.99	7
Document activities and extension programs delivered	183	2.69	0.95	8
Improve accessibility of EWs to agricultural specialized resources	181	2.80	0.99	9
Summarize information using figures and charts	183	2.66	0.95	10
Prepare slides through multimedia software	183	2.61	1.04	11
Increase the speed of EWs' information acquisition from research	183	2.70	1.08	12
Prepare short video films through multimedia Software	183	2.62	1.05	13
Improve EWs' skills	182	2.35	0.95	14
Learn about presentation skills for conferences/seminars	183	2.62	1.06	15
Improve discussion among EWs through computer network	183	2.41	0.99	16
Facilitate accessibility to legislative information	182	2.51	1.04	17
Updates administration rules	182	2.51	1.04	18
Improve linkages between EWs and researcher	181	2.37	1.03	19
Present group training to farmers through video conference	182	2.33	1.00	20
Present advisory services to different farmer groups	182	2.24	1.02	21
Summated score	**183**	**55.45**	**15.89**	

*Mean of age = 37.83, SD = 8.16 and range between 23 to 55 years old.
** Mean of work experience = 9.42, SD = 7.57 and range between 1 to 29 years of experience.

Science degree. A little over one-third of the respondents (35.8%) indicate their major area of study in other agricultural majors such as farm machinery, plant pathology, food science, irrigation, and horticulture. Nearly 28% reported agronomy as a major followed by a major other than agriculture (15.1%). On average, respondents had 9.42 years of work experience. A little over one-half of the respondents (52.5%) worked in a county level. Employment status of respondents was more or less evenly divided (49.0%) among tenured and (51%) non tenure personnel.

Objective 2: Application of ICT in agricultural extension by EWs;

This part of the survey concerned the principal areas of applying ICTs by EWs in extension and identified from previously reported research findings. EWs responded to 21 items using the following type scale: 1 = not at all, 2 = slightly, 3 = quite a bit and 4 = very much.

A summery is shown in Table 2. It shows means and standard deviations for each of the 21 ICT applications. The statements which the respondents used most were: "typing letters/report" (M=3.24, SD=0.92), and "Prepare and protect file on process basic agricultural and rural information"(M=2.89, SD=0.87), and "access to the latest agricultural news and information" (M=3.00, SD=0.97). Overall, the result of the Mean (55/45), and Standard Deviation (15/89), indicate that the EWs in the study approximately use ICT quite a bit.

Objective 3: Factors encouraging and discouraging to the use of ICT by EWs;

At first, Table 3 presents means and standard deviations for each of the 25 encouraging factors to the use of ICT by EWs. The most effective items to use of ICT which the respondents statement were: "Provide a competitive environment for presenting ICT services"(M=3.40, SD=0.80), and "Identify appropriate applications for effect use of ICT"(M=3.39, SD=0.81), and "Develop step by step policies for logical hieratical application of ICT"(M=3.39, SD=0.82), and "Develop implementation plans for ICT in extension"(M=3.34, SD=0.81).

As is shown in Table 4 "EWs low level of knowledge and skills in regard to information" (M=3.64, SD=0.64), and "The cost of establish-

Table 3: Means and Standard Deviations Factors encouraging to the use of ICT by EWs; (N = 183).

Items	n	Mean*	S.D	Rank
Provide a competitive environment for presenting ICT services	183	3.40	0.80	1
Identify appropriate applications for effect use of ICT	181	3.39	0.81	2
Develop step by step policies for logical hieratical application of ICT	181	3.39	0.82	3
Develop implementation plans for ICT in extension	182	3.34	0.81	4
Develop program guidelines for ICT activities	182	3.33	0.81	5
Reduces taxes and communication expenses for ICT	180	3.42	0.84	6
Provide secure appropriate hardware and software for extension	180	3.40	0.84	7
Develop appropriate websites in Persian languages	183	3.51	0.87	8
Establish continuous flow of information from research to key stakeholders	183	3.41	0.85	9
Use government's free policies on ICT services	183	3.25	0.82	10
Establish a central portal for coordinates of organizations	183	3.35	0.87	11
Provide access to rural social centers as an ICT center	180	3.24	0.85	12
Appoint responsible and specialist people for ICT units	183	3.26	0.86	13
Encourage collaboration of EWs with computer specialists	183	3.37	0.89	14
Create maintenance services and desire support for ICT users	181	3.25	0.86	15
Establish ICT unit in organization structure of extension	183	3.25	0.88	16
Involve Clients in all the phases of ICT development applied	179	3.21	0.87	17
Encourage private sectors to invest in Extension-ICT activities	179	3.36	0.92	18
Maintain equal possible accessibility to ICT for EWs	183	3.30	0.92	19
Educate EWs for the appropriate use of ICT	179	3.23	0.92	20
Basic structure for distance education at different levels	183	3.26	0.93	21
Increase capacity of information exchange and communication	181	3.29	0.94	22
Revise social and cultural procedures in educational and social structure of extension	180	3.22	0.96	23
Develop local networks for ICT-Extension	183	3.22	1.01	24
Increase the level of English proficiencies among EWs	181	3.22	1.04	25
Summated score	**183**	**145.98**	**22.9**	

* Mean computed on a scale 1 = not at all, 2 = somewhat, 3 = slightly, and 4 = very much

ing and operating data centers specialized in agricultural extension" (M=3.93, SD=0.72), and "Limited accessibility to technical and supportive person" (M=3.57, SD=0.68) were the most effective items to ICT usage that statement with respondent. Finally, "Lack of up-to-date information in extension" (M=3.51, SD=0.68), and "Lack of holistic information in extension" (M=3.51, SD=0.69), and "Lack of precise information in extension" (M=3.50, SD=0.69) allocated 4th to 6thranks in priority.

In continuous, principal factor analysis was performed to identify factors that underlie encouraging and discouraging to the use of ICT by EWs. The main objective of this technique is to classify a large number of variables into a small number of factors based on relationships among variables. For reporting factor analysis data, the procedures suggested by Warm rod (2000) were used. These included: sample size, list and scale of measurement used for the observed variables, means and standard deviations for the observed variables, factor loadings, final communalities, Eigen values for each factor extracted, proportion of common variance explained for each factor, total variance, and correlation matrix. Factors with Eigen values greater than 1 were retained and rotated to a varimax solution for interpretation. In addition, Cronbach's alpha for each extracted factor was reported.

The variables which loaded on each of the four encouraging factors and six discouraging factors to the use of ICT by EWs were given to a panel of experts to "name" the factors. The panel consisted of faculty members, and graduate students in the department of Agricultural and Extension Education. Making sense of the panel's judgment was very difficult. In addition, to give a specific name for each factor was even more difficult. The names of the two categories and Their factors are given below.

1- Encouraging Factors:

Factor 1 - Providing easy access to the ICT Unit

Factor 2 - Develop strategic plan for developing ICT units

Table 4: Means and Standard Deviations Factors discouraging to the use of ICT by EWs; (N = 183)

Items	n	Mean*	S.D	Rank
EWs low level of knowledge and skills in regard to information	183	3.64	0.64	1
The cost of establishing and operating data centers specialized in agricultural extension	181	3.93	0.72	2
Limited accessibility to technical and supportive person	179	3.57	0.68	3
Lack of up-to-date information in extension	181	3.51	0.68	4
Lack of holistic information in extension	181	3.51	0.69	5
Lack of precise information in extension	181	3.50	0.69	6
Lack of appropriate policy for collaborating between government and private sectors regarding ICT	183	3.50	0.71	7
Lack of communications equipment in rural areas and extension	183	3.55	0.74	8
Lack of subject matter software in Persian language	181	3.55	0.75	9
High maintenance cost relative to linkage and up-to-date appropriate content	183	3.43	0.73	10
Lack of appropriate Persian websites	179	3.52	0.76	11
Limited in-service training in the area of ICT for EWs	180	3.44	0.77	12
Lack of commitment of some stakeholders in country's agricultural knowledge and information system	176	3.29	0.76	13
Lack of interest to the application of ICT among EWs	183	3.40	0.79	14
Lack of interest to the application of ICT among policy makers	183	3.40	0.80	15
Weak structure in extension organization at different levels	183	3.47	0.82	16
Poor network security	183	3.21	0.79	17
High cost of buying and maintenance of ICT hardware and software	183	3.33	0.83	18
Existence of social and cultural barriers at different level	183	3.10	0.84	19
Social and cultural Weak to look at (viewed) ICTs as a goal not as a tool in agricultural extension	182	3.07	0.84	20
Anxiety around risks as a result of misuse of ICT	182	3.12	0.88	21
Lack of EWs self-esteem in utilizing ICT	181	3.08	0.88	22
ICT is viewed as "fancy" in extension	182	2.99	0.87	23
ICT is not a priority for EWs	183	3.09	0.91	24
Summated score	**183**	**81.20**	**19.3**	

* Mean computed on a scale 1 = not at all, 2 = somewhat, 3 = slightly, and 4 = very much

Factor 3 - Provide the requirements and tools

Factor 4- Provide government's free competitive environment for service delivery

2- Discouraging Factors

Factor 1 - Poor infrastructure

Factor 2 – Extension Weakness in Providing Information

Factor 3- Extension Weakness in providing requirements.

Factor 4- Social and cultural barriers

Factor 5- Lack of interest in the use of ICT

Factor 6- The high cost of installation of ICT

For EWs ICT Encouraging Items factor analysis extracted four factors which accounted for 76.24% of the total variance. The final statistics (Eigen values, percent of variance explained, Reliability (alpha), and factor loadings for each of the four factors are shown in Table 5. Factor 1 explained 64.56% of the total variance. Thirteen variables loaded on this factor. The variable, maintain equal possible accessibility to ICT for EWs, was most representative of Factor 1 (r = 0.767). Factor 2 explained 4.31% of the total variance. Five variables loaded on this factor. The variable, develop program guidelines for ICT activities, was most representative of Factor 2 (r = 0.847). Factor 3 explained 4.08% of the total variance and five variables loaded on this factor. The variable, increase the level of English proficiencies among EWs, was the most representative of Factor 3 (r = 0.796). Factor 4 explained 3.29% of the total variance with two variables loaded on this factor. The statement, use government's free policies on ICT services, was most representative of Factor 4 (r = 0.696).

Upon examination of the factor loadings and the items which loaded on each of the four factors, internal consistency estimates were computed for the four factors. The reliability estimates for the four factors ranged from a low

Table 5: Factors, Reliabilities, Variance Explained, Eigen Values, and Factor Loadings for EWs ICT Encouraging Items (N = 183).

Factor, Reliability Variance explained Eigen Value	Items	Factor Loading
	Establish ICT unit in organization structure of extension	.600
Factor 1 (13)	Appoint responsible and specialist people for ICT units	.594
0.97	Maintain equal possible accessibility to ICT for EWs	.767
64.56%	Identify appropriate applications for effect use of ICT	.594
9.016	Reduces taxes and communication expenses for ICT	.702
	Encourage private sectors to invest in Extension-ICT activities	.597
	Establish continuous flow of information from research to key stakeholders	.628
	Develop local networks for ICT-Extension	.696
	Revise social and cultural procedures in educational and social structure of extension	.608
	Develop appropriate websites in Persian languages	.751
	Establish a central portal for coordinates of organizations	.628
	Provide access to rural social centers as an ICT center	.511
	Encourage collaboration of EWs with computer specialists	.688
Factor 2 (5)	Involve clients in all the phases of ICT development applied	.525
0.93	Create maintenance services and desire support for ICT users	.623
4.31%	Develop program guidelines for ICT activities	.847
5.735	Develop implementation plans for ICT in extension	.843
	Develop step by step policies for logical hieratical application of ICT	.608
Factor 3 (5)	Basic structure for distance education at different levels	.642
0.91	Increase capacity of information exchange and communication	.677
4.08%	Provide secure appropriate hardware and software for extension	.582
5.187	Increase the level of English proficiencies among EWs	.796
	Educate EWs for the appropriate use of ICT	.578
Factor 4 (2)	Use government's free policies on ICT services	.696
0.79	Provide a competitive environment for presenting ICT services	.628
3.29%		
3.698		

Note. Figures in parentheses in the left column indicate total number of items in each factor.

0.79 (Factor 4) to a high of 0.97 (Factor 1). (See Table 5).

Factor analysis for EWs ICT discouraging Items extracted six factors which accounted for 62.84% of the total variance. Eigen values, percent of variance explained, alpha, and factor loadings for each of the six factors are shown in Table 6. Factor 1 explained 31.79% of the total variance. Six variables loaded on this factor. The variable, lack of subject matter software in Persian language, was most representative of Factor 1 (r = 0.812). Factor 2 explained 9.24% of the total variance. Three variables loaded on this factor. Three variables, were equal (r = 0.951). Factor 3 explained 7.97% of the total variance and four variables loaded on this factor. The variable, weak structure in extension organization at different levels, was the most representative of Factor 3 (r = 0.820). Factor 4 explained 5.69% of the total variance with four variables loaded on this factor. The statement, ICT is viewed as "fancy" in extension, was most representative of Factor 4 (r = 0.822). Factor 5 explained 4.16% of the total variance with four variables loaded on this factor. The statement, Low education level among EWs, was the most representative of Factor 5 (r = 0.768). Factor 6 explained 3.99% of the total variance. Three variables loaded on this factor. The variable, limited in-service training in the area of ICT for

Table 6: Factors, Reliabilities, Variance Explained, Eigen Values, and Factor Loadings for EWs ICT Discouraging Items (N = 183).

Factor, Reliability Variance explained Eigen Value	Items	Factor Loading
Factor 1 (6)	Poor network security	0.565
0.82	Limited accessibility to technical and supportive person	0.569
31.79%	Lack of commitment of some stakeholders in country's agricultural knowledge	0.476
3.656	and information system	0.463
	Anxiety around risks as a result of misuse of ICT	0.771
	Lack of appropriate Persian websites	0.812
	Lack of subject matter software in Persian language	0.951
Factor 2 (3)	Lack of holistic information in extension	0.951
0.99	Lack of precise information in extension	0.951
9.24%	Lack of up-to-date information in extension	
3.387		
Factor 3 (4)	Lack of communications equipment in rural areas and extension	0.775
0.78	Weak structure in extension organization at different levels	0.820
7.97%	EWs low level of knowledge and skills in regard to information	0.696
3.170	Lack of appropriate policy for collaborating between government and private sectors regarding ICT	0.527
Factor 4 (4)	Lack of EWs self-esteem in utilizing ICT	0.462
0.76	Existence of social and cultural barriers at different level	0.718
5.69%	ICT is viewed as "fancy" in extension	0.822
3.040	Social and cultural Weak in Considering ICTs as a goal not as a tool	0.764
Factor 5 (4)	Lack of interest to the application of ICT among policy makers	0.573
0.82	Lack of interest to the application of ICT among EWs	0.573
4.16%	ICT is not a priority for EWs	0.715
2.389	Limited in-service training in the area of ICT for EWs	0.768
Factor 6 (3)	The cost of establishing and operating data centers specialized in agricultural extension	0.488
0.58	High cost of buying and maintenance of ICT hardware and software	0.835
3.99%	High maintenance cost relative to linkage and up-to-date appropriate content	0.507
1.851		

Note. Figures in parentheses in the left column indicate total number of items in each factor.

EWs, was most representative of Factor 6 (r = 0.835).

Internal consistency estimates were computed for the six factors to upon examination of the factor loadings and the items which loaded on each of the six factors. The reliability estimates for them are shown in Table 6. The reliability estimates ranged from a low 0.58 (Factor 6) to a high of 0.99 (Factor 2).

Objective 4: Relationships between encouraging (four factors) and discouraging (six factors) and application of ICT by EWs.

Pearson Correlation Coefficients were calculated to describe the relationships between encouraging, discouraging ICT application factors and application of ICT by EWs. In spite of Factor 2 (r = 0.165), in encouraging ICT factors none of the four factors of encouraging items was found to be related to ICT application (Table 7). However, some of the discouraging factors such as factor 3 (r = -0.152), and factor 5(r =-0.169), were significant at the .05 level. Multiple regression analyses using the ENTER procedure (simultaneous entry of all variables) was conducted to determine the importance of variables in explaining variance in the ICT application.

Table 7: Summary of ICT Scores and Pearson Correlation Values between Encouraging and Discouraging ICT Adoption by ICT Application Scores (n = 183)

Factors	Summated Mean Score	Summated SD	r	p
ICT Application (21 Items)	**55.45a**	**15.89**	**-**	**-**
Encouraging ICT Adoption (25 Items)	81.20b	19.30	0.155	0.037
Factor 1 (13- 68)d	55.81	11.98	0.130	0.078
Factor 2 (5 - 24)d	19.81	4.23	0.165	0.026
Factor 3 (5 - 20)d	16.33	3.99	0.133	0.073
Factor 4 (2 - 12)d	9.82	2.23	0.137	0.065
Discouraging ICT Adoption (24 Items)	**145.98c**	**22.90**	**- 0.134**	**0.070**
Factor 1 (6 - 28)d	23.44	3.77	-0.072	0.330
Factor 2 (3 - 12)d	10.53	2.06	-0.023	0.759
Factor 3 (4 - 16)d	14.17	2.30	-0.152	0.040
Factor 4 (4 - 16)d	12.50	2.50	-0.060	0.421
Factor 5 (4 - 16)d	13.26	2.65	-0.169	0.022
Factor 6 (3 - 12)d	10.11	1.72	-0.067	0.370

a) Mean computed on a scale 1 = Not at All to 4 = Very Much and could range from a low of 21 to high of 84 with theoretical mid-point of 52.5
b) Mean computed on a scale 1 = Not at All to 4 = Very Much and could range from a low of 31 to high of 124 with theoretical mid-point of 77.5
c) Mean computed on a scale 1 = Not at All to 4 = Very Much and could range from a low of 29 to high of 116 with theoretical mid-point of 72.5
d) Numbers in parentheses indicates the range of scores for each of the factors.

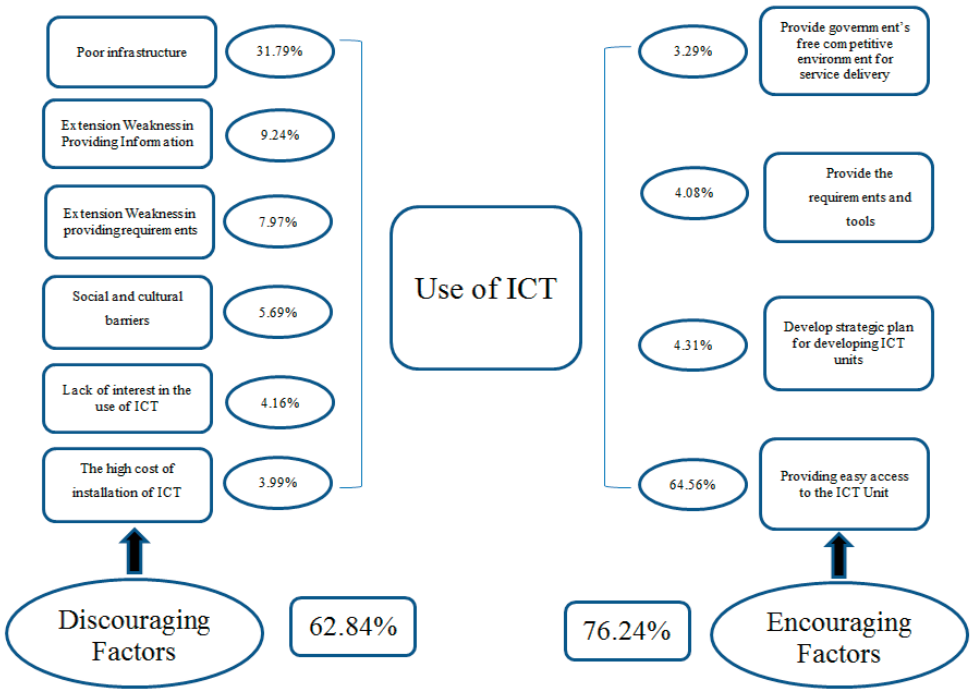

Figure 1: The Encouraging and Discouraging Factors to the Use of ICT by EWs.

CONCLUSIONS AND RECOMMENDATIONS

Extension increasingly acknowledges the importance of new ICTs. In fact, technologies are now being considered as a basic component of any extension program. ICTs modify the practice of extension services and open interesting avenues for the collection and dissemination of local knowledge and its integration with modern and global knowledge, requiring a redefinition of knowledge management.

Overall, findings indicated that majorities (87%) of the respondents were male. Age of respondents was distributing evenly among the three groups (23.5% under 30 years; 36.0% between 31-40 years and 35.0 % between 41-50 years). Three of five respondents (59%) had completed Bachelor of science degree. A little over one-third of the respondents (35.8%) indicate their major area of study in other agricultural majors such as farm machinery, plant pathology, food science, irrigation, and horticulture. Nearly 28% reported agronomy as a major followed by a major other than agriculture (15.1%). On average, respondents had 9.42 years of work experience. A little over one-half of the respondents (52.5%) worked in a county level. Employment status of respondents was more or less evenly divided (49.0%) among tenured and (51%) non tenure personnel. Overall, the results of the study indicate that the EWs in the study approximately use ICT quite a bit.

Our study identified the typing letters/ report, access to the latest agricultural news and information, prepare and protect file on process basic agricultural and rural information as a main area for ICT application by EWs in extension activities.

Based on our findings, we also recommend the present advisory services to different farmer groups, present group training to farmers through video conference and Improve linkages between EWs and researcher as well as for typing letters/report, access to the latest agricultural news and information and other priorities. This ICT applications requires a substantial investment in ICTs. Information and communication technologies allow extension workers to enter information concerning events and upload it through the Internet to a central database. In addition, we recommend the providing easy access to the ICT units.

To achieve the goal of ICT application by EWs, there are some main encouraging (namely providing easy access to the ICT Unit, develop strategic plan for developing ICT units, provide the requirements and tools, and provide government's free competitive environment for service delivery) and discouraging (namely poor infrastructure, extension weakness in providing information, extension weakness in providing requirements, social and cultural barriers, lack of interest in the use of ICT, high cost of installation of ICT) factors. The agricultural extension in Isfahan Province should overcome and transform the challenges to the opportunities and straight encouraging factors, too. In an environment, agricultural extension organization familiar with the challenges could transform them to the opportunities, and lack of familiarity with the nature of discouraging factors would transform them to threats. Future research is needed to deepen the analysis of these factors and in order to pursue the major research question - on what is of particular importance in settings with low experience and exposure to ICT. Despite many limitations, there are prospects to incorporate ICTs into the extension system in Iran. The requisite investment should be recommended in agricultural development plans and a certain percentage of the total budget of state-sponsored projects should be allotted for ICTs. For extension to realize the full potential of ICTs in agricultural development, the current discouraging factors must be addressed. Extension needs appropriate infrastructure, information, requirement, increase interest and financial support from the government.

In order to incorporate ICT into the extension system, EWs should be provided government's free competitive environment for ICT application. Every extension center should be equipped with an established minimum standard for ICT capability in order to conduct ICT based courses and improve communication skills of extension staff. Lastly, agricultural extension planners and policy makers should pay attention to the 10 encouraging and discouraging factors when integrating ICTs with extension processes.

The study recommended among others that, there should be a periodic review of the use of current ICTs in among EWs to facilitate effectiveness in the use of ICTs for extension service and adequate funding of extension service should also be ensured to enhance the maintenance of ICTs made available to extension personnel.

Finally, in this study Pearson Correlation Coefficients were calculated to describe the relationships between encouraging, discouraging ICT application factors and application of ICT by EWs. None of the four factors of encouraging items was found to be related to ICT application

in spite of factor 2. In related to discouraging factors, some of them such as factor 3, and factor 5, were significant at the .05 level.

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