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An Assessment of Readiness and Barriers towards ICT Programme Implementation: Perceptions of Agricultural Extension Officers in Indonesia

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ABSTRACT

This study investigates agricultural extension officers' perception of readiness and barriers towards implementation of ICT programme. Data were gathered from 312 extension officers affiliated with public organisations of the Ministry of Agriculture in four regencies of Indonesia. Descriptive statistics, exploratory and confirmatory factor analysis, and one-way ANOVA were applied to analyse the data. In order to provide better insights, this study adopts the assessment model of e-LRS to measure the readiness of ICT programme implementation. The first finding reveals that they perceived that three out of the four factors of readiness as positive. The e-LRS assessment revealed that they perceived farmer readiness as lowest and thus considered it as a barrier. The second finding reveals that technological and organisational cultures were also seen as the main barriers of ICT programme implementation. The third findings show that they felt that the two demographic variables, regency and age, must also be considered when ICT programmes are implemented. The results of this study can provide guidance to the government or relevant organisations when considering readiness and barriers towards implementing ICT programmes. In addition, this study advances the theory of adoption behavior and contributes to the foundation for future research aimed at improving our understanding of agricultural extension officers' behavior.

Keywords: *ICT; agricultural extension officers; readiness; perceived barriers.*

INTRODUCTION

The use of information and communication technology (ICT) is becoming progressively more widespread throughout various sectors including education, business as well as agriculture. One of the most popular ICT applications is e-Learning. With e-Learning, we can use available technologies to enhance learning and expand access to education and training in the agricultural sector. The use of e-Learning systems in the field of agricultural extension is becoming popular due to the development of ICT. Omotayo (2005) observes that frontline extension workers who become the direct link between farmers and other actors in the extension of agricultural knowledge and information systems are well positioned to make use of ICT to access expert knowledge or other types of information that could facilitate the accomplishment of the farmers' routine activities.

According to Technical Centre for Agricultural and Rural Cooperation (CTA) (2003), ICT are technologies which facilitate communication and thus the processing and transmission of information electronically. Quoting the United States Agency for International Development, Akpabio et al (2007) clarify that ICT includes technologies and methods for storing, managing and processing as well as communicating information. Scholars Adebayo and Adesope (2007) describe ICT as scientific, technological and engineering disciplines and the management technologies used in the handling of information, processing and applications related to computers. ICT as an extension tool could enhance the flow of information in the

application of agricultural extension services. Ballantyne and Bokre (2003) indicate that agricultural extension, which depends to a large extent on information exchange between and among farmers, has been identified as one area in which ICT can have a particularly significant impact. Further, Annor-Frempong et al (2006) noted that these technologies are increasingly being seen as cost-effective and as practical tools to facilitate information delivery and knowledge sharing among farmers, extension agents and other stakeholders.

Indonesia's economic growth as a big developing country in Asia is supported by the agricultural sector. The fact that Indonesia is an archipelago country covering such a vast area, should allow e-Learning as a suitable choice for ICT implementation to support the nation's effort in delivering education to all the people (Koswara & Maria 2004). Recently, the Indonesian Ministry of Agriculture boosted the ICT programme through a project called FEATI (Farmer Empowerment through Agricultural Technology and Information Project). This is a joint-project with the International Bank for Reconstruction and Development (IBRD). The FEATI project aimed to help the Ministry of Agriculture expand its services through the development of a comprehensively integrated information and knowledge management system with broad outreach and valuable services.

ICT programme implementation in a developing country relies on various facets such as infrastructure, government policy, cultural factors, organisational and human resources. Human resources are one of crucial factors to help diffuse the ICT programme. Hence, this study focuses on the human resources factor to investigate the readiness and barriers perceived by agricultural extension officers (AEO). This study intends to explore factors, which may need to be improved before the ICT programme is implemented. Identifying these factors will help increase the knowledge regarding the officers' perception of using ICT for the agricultural sector. Assuming that these factors can be clearly identified, the information can be used by the extension organisation to increase the use of this approach of learning as well as improve the quality of agricultural learning. This, in turn, will have a positive impact on sustainable agricultural development in Indonesia and the economy of the developing country in general. The results will also serve as a valuable baseline of ICT diffusion, so that the growth or decline of this approach can be tracked.

Therefore, the main purpose of this study is to investigate the AEO readiness and barriers towards ICT programmes in the agricultural sector. This study is performed with the guidance of the following research questions:

1. What is the readiness level as perceived by the AEO towards ICT programme implementation?
2. What is the barriers level as perceived by the AEO towards ICT programme implementation?
3. Do demographic variables (regency, gender, age, education, job category) of AEO affect their perception of readiness and barriers towards ICT programme implementation?

LITERATURE REVIEW

Nowadays, the majority of Asians in developing countries need to build massive ICT infrastructures to take advantage of agricultural information (Woods et al 2002). By using ICT, particularly the Internet, agricultural information is accessed more easily and the scope for communication also enlarges. There are experiences gained from the involvement of ICT within organisations in Asian such as the International Rice Research Institute (IRRI) and Asia Pacific Regional Technology Centre (APRTC) and Sustainable Development e-Learning Network (SDLEARN). They found that application of ICT on e-Learning in particular, is an effective alternative in addressing the continuing educational needs of agricultural knowledge especially in the areas of sustainable agriculture and natural resource management (Abdon et al 2006).

The benefits of utilisation of ICT as an e-Learning media for agricultural extension and training purposes are well documented (Hafkin & Odame 2002; Richardson, 2005). Chamala and Shingi (1996) confirm that ICT use for extension activities will ultimately transform extension officers into catalysts, who play their roles of empowerment in community organisations, human resource development, problem solving and educating farmers. Furthermore, Richardson (2005) argues that extension organisations have a key role in brokering between communication technologies, providing technologies and services, and the client groups they serve. Woods et al (2002) underlines that the traditional role of extension workers includes assessing and articulating technological needs of the farmers, studying and developing new technology, testing and evaluating new technology, and transferring new technology to farmers. In particular, AEO have a significant role in bridging the technological gap between the existing scientific knowledge base and information and knowledge of the farmers. As of now, the most appropriate target learners of ICT programmes are knowledgeable intermediaries such as AEO.

On the other hand, ICT programme implementation relies on various facets such as the infrastructure, government policy, cultural factors, organisational factors, and human resources. Soekartawi (2005) identifies some problems in developing countries as being related to infrastructure and Internet connection, human resources, policy support from government and pedagogy. He emphasises that human resources is one of crucial factors to diffuse utilizing ICT to learners. Kauffman and Kumar (2005) introduce three stages of diffusion of ICT at the country level of analysis are the ICT readiness stage, the ICT intensity stage and the ICT impact stage. In the first stage of ICT readiness, they argue that when the technology is new to a country or a region, the readiness of its people to adopt it is a crucial issue. On the other hand, Kaur and Abas (2004) noted that ICT readiness assessment allows one to design comprehensive e-Learning strategies and effectively implement ICT goals. Hence, generally ICT readiness assessments help a country's leaders to measure and plan for ICT integration, focus their efforts and identify areas where further attention is required (Krull 2003).

Quoting the Merriam Webster's Online Dictionary, So and Swatman (2006) clarify that readiness is defined as being "*prepared mentally or physically for some experience or action*". In terms of e-Learning, Borotis and Poulymenakou (2004, p.1622) defined e-Learning readiness as "*the mental or physical readiness of an organization for some e-Learning experience or action*". Trinidad (2002) proposes an initial assessment of the Philippines' preparedness for e-Learning which consisted of several technological factors such as computer, internet, and telephone line readiness; educational factors such as network learning, network society, network economy and network policy; English proficiency and computer/internet literacy. Chapnick (2000) differentiates model group factors into eight categories: psychological, sociological, environmental, human resources, financial, technological skill, equipment and content readiness. Another scholar, Watkins (2003) proposes the initial self assessment instrument consisted of 40 statements related to readiness for e-Learning success, which were grouped into 10 scales (e.g. technology access, technology skills, online readings and Internet chat).

A previous study from Mungania (2003) revealed that e-Learning barriers are heterogeneous, encompassing seven types of barriers, namely: (1) personal or dispositional, (2) learning style (3) instructional, (4) situational, (5) organisational, (6) content suitability, and (7) technological barriers. Muilenburg and Berge (2005) determine eight barriers factors to online learning including administrative/instructor issues, social interactions, academic skills, technical skills, learner motivation, time and support for studies cost and access to the Internet and technical problems. A more recent study by Ali and Magalhaes (2008) divided the barriers in the adoption of e-Learning into two factors: organisational and technical issues. As for the technical barriers, the most commonly cited are system crashes, bandwidth and infrastructure upgrading, accessibility, usability, technical support and perceived difficulties in using such a system. The organisational barriers include lack of time available for training; cost versus value; lack of appropriate content related to specific needs; language barrier (as most of the

content is delivered in English); difficulties in measuring e-Learning effectiveness; lack of strategic planning and direction, lack of e-Learning awareness; lack of incentives; and finally, lack of management support (Baldwin-Evans 2004).

Some prior studies have demonstrated that demographic and characteristic background such as age, gender, ethnicity, marital status, level of education, prior experiences with computers and the Internet influence the ICT and or e-Learning adoption (Durndell & Thomson 1997; Whitely 1997; Teo & Lim 2000; Muilenberg & Berge 2005; Ong & Lay 2006). Therefore, this study which examines some key demographic variables which influence the readiness and barriers towards ICT programme implementation in Indonesia will be a significant contribution to knowledge in this area.

METHODS

This study carried out quantitative research to investigate perceptions of readiness and barriers towards ICT programme implementation. The methodology used in this study was the survey method, whereby researchers distribute hardcopies of questionnaires to respondents. Respondents of this study were AEO affiliated with public organisations of the Ministry of Agriculture of Indonesia from Central Java, including Yogyakarta, Indonesia. In the beginning stage, the government determined only four regencies among 35 regencies in Central Java should implement ICT programmes. Hence, all AEO in the four regencies were asked to participate in this study. The questionnaires were administrated to 546 AEO. A total of 336 questionnaires were returned, of which 312 were valid giving an effective response rate of 57.1%. Descriptive statistics, exploratory and confirmatory factor analysis, one-way analysis of variance (ANOVA) and post hoc test Scheffe's Multiple Comparisons were applied to analyse the data using SPSS version 15.

In order to provide better insights on readiness, this study applied the assessment model from Aydin and Tasci's study (2005). They argued that alternatives were designed in a way that provides easy coding and assessment for the users. Moreover, they detailed that the alternatives can easily be coded as 1, 2, 3, 4 and 5, as in a five-point Likert scale. Therefore, the mean score of 3.4 can be identified as the expected level of readiness, while other responses enable organisations to show higher or lower levels of readiness. The mean average of 3.4 was determined after identifying the critical level: 4 intervals/5 categories = 0.8 (see Figure 1).

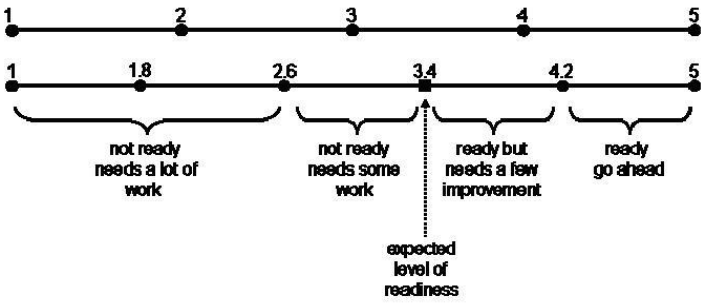

***Figure 1**: Assessment model of the e-LRS*

The questionnaire was developed through two steps. In the first step, the questionnaire was adopted from previous studies. The items of measurement for readiness were adapted from So and Swatman (2006). To measure the organisational culture and individual barriers, this study adapted the questionnaire from Mungania (2003). The items of measurement of technological barriers were adopted from Akpabio et al (2007), while the policy barriers were

adopted from Soekartawi (2005). In the second step, several in-depth interviews were conducted with the head of the Extension Development Center and the head of FEATI projects from the Ministry's Agriculture Department to explore the research area and to clarify terminology (e.g. Which are the most suitable areas to conduct this research? Are the questions easy to understand by the respondents?). A five-point Likert scale was used for 47-items with responses ranging from strongly disagree (1) to strongly agree (5) (refer to Table 2 and 3).

RESULT AND DISCUSSION

Respondents' Demographic Variables

To provide a better insight into the participants, respondent demographic variables including regency, gender, age, education and job category were analysed. Table 1 show that the four regencies have almost the same number of respondents (around 25%). Gender composition consists of 79.2% male respondents. Most of the respondents are in the age range of 40-50 years old (51.3%). The highest level of education is that of a bachelor degree (60.3%). In terms of job category, a majority of the respondents (50%) are general extension officers, followed by those in forestry (13.1%) and foodstuff crops (11.5%).

***Table 1**: Respondents' demographical profile*

No.	Aspect	Options	Frequency	Percent
1.	Regency	1. Magelang	77	24.7
		2. Kulonprogo	76	24.4
		3. Bantul	80	25.6
		4. Gunungkidul	79	25.3
2.	Gender	1. Male	247	79.2
		2. Female	65	20.8
3.	Age (years old)	1. 20 – 30	26	8.3
		2. 30 – 40	39	12.5
		3. 40 – 50	160	51.3
		4. > 50	87	27.9
4.	Education	1. Senior high school	41	13.1
		2. Vocational	73	23.4
		3. Bachelor degree	188	60.3
		4. Master degree	10	3.2
5.	Job Category	1. General	156	50
		2. Plantation	23	7.4
		3. Forestry	41	13.1
		4. Foodstuff crops	36	11.5
		5. Livestock	26	8.3
		6. Fishery	17	5.4
		7. Contract employee	13	4.2

Reliability Analysis

Cronbach's Alpha was employed to investigate the reliability of the factors. According to Nunnaly (1978), a Cronbach's Alpha score of 0.70 or higher is considered to show proof of internal consistency. The results of exploratory factor analysis of readiness show that values of Cronbach's Alpha are higher than 0.80. As shown in the Table 2, acceptable reliability is demonstrated for each of the variables: 0.910 for farmer readiness, 0.812 for personal readiness, 0.804 for management readiness and 0.833 for infrastructure readiness.

***Table 2**: Result of exploratory factor analysis of readiness*

Items Questions	Factor			
	1	2	3	4
Farmer Readiness				
1. The farmers know that ICT can be used as a learning tool	.863			
2. The farmers are capable of managing their time in order to use ICT	.833			
3. The farmers have enough skills to use ICT	.814			
4. I think the farmers are ready to use ICT	.792			
5. Access to the Internet is not a problem for the farmers	.755			
Personal Readiness				
6. I know how ICT can be used as a learning tool		.689		
7. I think ICT is helpful in improving extension and learning		.709		
8. I think it is the right time to promote ICT in agricultural department		.702		
9. I am ready to integrate ICT utilities in my extension programme		.752		
10. I have enough ICT competency to prepare learning materials		.723		
Infrastructure Readiness				
11.The infrastructure in agricultural department can support ICT implementation				.878
12. The technical support is adequate to support ICT				.873
13. The agricultural department can afford the budget to use ICT in extension & learning				.754
Management Readiness				
14. My principal / senior management knows what is ICT			.778	
15. My principal / senior management supports the use of ICT			.858	
16. The agricultural department has a plan for ICT implementation in the coming future			.780	
Cronbach's Alpha	**0.910**	**0.812**	**0.804**	**0.833**
Eigenvalue	**6.208**	**2.331**	**1.554**	**1.306**
Cumulative Variance explained(%)	**38.80**	**53.37**	**63.02**	**71.18**

The results of exploratory factor analysis of perceived barriers show that values of Cronbach's Alpha are higher than 0.80. As shown in Table 3, acceptable reliability is demonstrated for each of the variables: 0.863 for the organisational culture barriers, 0.875 for the individual barriers, 0.848 for the technological barriers and 0.866 for the policy barriers.

***Table 3**: Result of exploratory factor analysis of barriers*

Items Questions	Factor			
	1	2	3	4
Organisation culture barriers				
1.Lack of training availability to learn ICT				.804
2.Limitations of technical support from organisation				.807
3.Interpersonal barriers to share among employee				.821
4.Lack of awareness in availability of ICT				.703
Individual barriers				
1.Lack of confidence in ability to use ICT	.653			
2.Lack of learner motivation towards using ICT	.753			
3.Language problems towards using ICT	.797			
4.Less preferences in using ICT	.751			
5.There is a lack of skills to use ICT	.819			
6.Time management problems in learning to use ICT	.741			
Technological barriers				
1.Poor infrastructure development in agriculture sector		.771		
2.The cost of broadband connection too high		.758		
3.Less-availability of ICT in agriculture sector		.789		
4.Low computer literacy level in agriculture community		.740		
5.Restricted use of available ICT in agriculture sector		.777		
6.Poor interconnectivity in the rural area		.692		
Policy barriers				
1.The existing government policies and regulations about ICT are shaky			.828	
2.Law related to ICT policies in agriculture sector are not support			.858	
3.Policies in implementation that include special rate for telephone or internet for agriculture sector are not support			.828	
4.Budgeting in the availability of ICT in agriculture sector are limited			.871	
Cronbach's Alpha	**0.875**	**0.848**	**0.866**	**0.863**
Eigenvalue	**5.26**	**3.54**	**2.83**	**1.41**
Cumulative Variance explained(%)	**26.28**	**44.00**	**58.16**	**65.20**

Measurement Validation

In this study, all measurement models were evaluated on multiple criteria such as uni-dimensionality, convergent validity and discriminant validity. Before a confirmatory factor analysis (CFA) of the measurement model was performed, an exploratory factor analysis (EFA) was conducted by principal component analysis (PCA) with varimax rotation. In order to decide which of the factors should be extracted and rotated, three methods were used: (1)

a cut point of 0.4 and no significant cross loading criteria; (2) screen plot tests and (3) consideration of eigen value magnitude and discontinuity (Hair et al 1998). As shown in Table 2 and Table 3, EFA results from both readiness and perceived barriers suggest a clean four-factor solution (with item loading >0.7 and small cross loading). The four factors of readiness corresponding to farmer, personal, infrastructure and management readiness, while the four factors of barriers are organisational culture, individual, technological and policy barriers.

Then, the four factor model with all indicators of these four constructs of readiness and barriers were estimated using CFA, which showed that both measurement models have acceptable fits. Since the modification of indices and estimated residuals were small, uni-dimensionality was also achieved (Sujan et al 1994). The convergent validity was evaluated with three criteria: (1) factor loading for an item should exceed 0.7, (2) composite reliability should be greater than 0.7, and (3) average variance extracted (AVE) for a construct should be greater than 0.5 (Fornell & Larcker 1981). Finally, discriminant validity was assessed by verifying that every construct's square root of AVE is larger than its correlations with other constructs (Fornell & Larcker 1981).

***Table 4**: Confirmatory factor analysis for convergent and discriminant validity of readiness*

	Items	**Composite Reliability**	**AVE**	**Factor correlations**			
Construct				1	2	3	4
1. Farmer readiness	5	0.911	0.672	**.820**			
2. Personal readiness	5	0.830	0.500	.183	**.707**		
3. Infrastructure readiness	3	0.831	0.623	.467	.159	**.790**	
4. Management readiness	3	0.838	0.635	.356	.351	.425	**.797**

All items loading in CFA were significant at p<0.001 level. The diagonal values are the square root of the AVE for each construct.

These results of confirmatory factor analysis for convergent and discriminate validity of readiness are shown in Table 4. All constructs show good convergent validity as all of the criteria were met. All factor loadings of the reflective indicators exceeded 0.7 and were significant at p<0.001. Composite reliabilities ranged from 0.830 to 0.911, and AVE ranged from 0.500 to 0.672. Each construct's AVE is above its squared correlation with other constructs. Thus, the measurement model exhibits a high degree of convergent and discriminate validities. The results of confirmatory factor analysis of perceived barriers are shown in Table 5. These measurement model also exhibit acceptable convergent and discriminant validity. All constructs show good convergent validity as all of the criteria were met. All factor loadings of the reflective indicators exceeded 0.7 and were significant at p<0.001. Composite reliabilities ranged from 0.851 to 0.876, and AVE ranged from 0.490 to 0.625. Each construct's AVE is above its squared correlation with other constructs.

***Table 5**: Confirmatory factor analysis for convergent and discriminant validity of barriers*

Construct	Items	Composite Reliability	AVE	Factor correlations			
				1	2	3	4
1. Organisational culture	4	0.863	0.615	**0.784**			
2. Individual barriers	6	0.876	0.544	.571	**0.738**		
3. Infrastructure barriers	6	0.851	0.490	.145	.100	**0.700**	
4. Policy barriers	4	0.869	0.625	.134	.126	.148	**0.790**

All items loading in CFA were significant at p<0.001 level. The diagonal values are the square root of the AVE for each construct.

The goodness fit of measurement model was also examined, such as X^2/df which should be less than 5 (Bentler 1989); adjusted goodness-of-fit index (AGFI) which should be larger than 0.8 (Henry & Stone 1994; Scott 1994); goodness-of-fit index (GFI), and comparative fit index (CFI) which should all exceed 0.9; and root mean square error of approximation (RMSEA) which should be less than 0.10 (Hair et al 1998). As shown in the Table 4 and 5, the results revealed measurement fit of readiness as X^2/df=3.122; AGFI=0.860; GFI=0.906; CFI=0.935 and RMSEA=0.083, while the measurement fit of perceived barriers are X^2/df=2.250; AGFI=0.868; GFI=0.897; CFI=0.932 and RMSEA=0.063.

Readiness towards ICT

The four factors of readiness towards ICT programmes were investigated, including readiness categories that are classified as farmer, personal, infrastructure and management readiness.

***Table 6:** One-way ANOVA of readiness*

Variables	Demographic	N	Farmer readiness			Personal readiness			Infrastructure readiness			Management readiness		
			Mean	F value[a]	Post Hoc[b] Test	Mean	F value[a]	Post Hoc[b] Test	Mean	F value[a]	Post Hoc[b] Test	Mean	F value[a]	Post Hoc[b] Test
Regency	1. Magelang	77	2.95	19.75**	1>2,4*	3.96	26.15**	1>2,4*	3.70	30.12**	1>2*	4.01	13.775**	1>2*
	2. Kulonprogo	76	2.18		3>2*	3.56		2>4*	3.06		4>1,2,3	3.36		3>4*
	3. Bantul	80	2.73		3>4*	3.67		3>4*	3.57		*	3.90		
	4. Gunungkidul	79	1.95			3.01			4.26		3>2*	3.48		
Gender	1. Male	247	2.47	0.42	none	3.82	0.48	none	3.82	0.48	none	3.82	0.477	none
	2. Female	65	2.38			3.76			3.76			3.76		
Age	1. 20 – 29.99	26	2.06	1.48	Ns	3.61	4.77*	2>3,4*	3.02	6.14**	2,3,4>1*	3.62	0.810	Ns
	2. 30 – 39.99	39	2.53			3.96			3.65			3.78		
	3. 40 – 49.99	160	2.47			3.49			3.79			3.64		
	4. > 50	87	2.49			3.44			3.58			3.78		
Education	1. S. high school	41	2.46	0.47	Ns	3.44	3.80*	4>2*	3.86	3.72*	Ns	4.00	2.599	Ns
	2. Vocational	73	2.45			3.38			3.83			3.61		
	3. Bachelor	188	2.43			3.60			3.52			3.65		
	4. Master	10	2.82			4.15			4.03			3.83		
Job category	1.General	156	2.53	1.63	Ns	3.66	2.92**	Ns	3.58	3.19**	Ns	3.76	1.773	Ns
	2. Plantation	23	2.82			3.83			4.23			3.68		
	3. Forestry	41	2.14			3.29			3.58			3.87		
	4. Foods crops	36	2.24			3.27			3.97			3.51		
	5. Livestock	26	2.44			3.40			3.50			3.58		
	6. Fishery	17	2.53			3.50			3.33			3.27		
	7. Contract employee	13	2.38			3.59			3.56			3.67		
Overall		312	2.45			3.55			3.66			3.69		

[a]*P < .05 and **P < .01

[b]Post hoc test Scheffe's Multiple Comparisons differences at p < .05

ns : non significant

Farmer readiness

Table 6 shows that only regency (F=19.75, p<.01) demonstrates a significant difference with farmer readiness. The result of the post hoc test on regency reveals that Magelang is significantly different than Kulonprogo and Gunungkidul (p<.05). Besides, Bantul is significantly different than Kulonprogo and Gunungkidul (p<.05). These findings indicate that regional differences in implementation of ICT programme will lead to differences in the readiness of farmers as perceive by AEO. Overall, farmers' readiness towards ICT has a mean score of M=2.45 (SD=1.006). This mean score indicates that farmers' readiness towards ICT tended to be negatively perceived by AEO.

Personal readiness

Table 6 shows that demographic variables such as regency, age, education and job category detect significant differences with personal readiness. The results show significant differences with regency (F=26.15, p<.01), age (F=4.79, p<.05), education (F=3.79, p<.05) and job category (F=2.92, p<.01). The results of the post hoc analysis reveal significant differences among demographic variables on regency, age and education. For example, education shows that having a master's degree is significantly different (p<.05) from having a vocational degree. Also age differences exhibit that age range 30-39.9 is better than age range 40-49.9 and >50 years old (p<.05) in the perception of ICT programme implementation. Overall, personal readiness towards ICT has a mean score of M=3.55 (SD = 0.769). This mean score indicates that personal readiness towards ICT tends to be positively perceived by AEO.

Infrastructure readiness

Table 6 shows that demographic variables regency (F=30.12, p<.01), age (F=6.14, p<.01), education (F=3.72, p<.05) and job category (F=3.19, p<.01) demonstrate a significant difference with infrastructure readiness. Results of the post hoc test shows a significant difference (p<.05) with regency and age but no differences were found for education and job category. The post hoc test of age exhibit that the age range 20-29.9 has a different perception (p<.05) with other age ranges. Their perception of infrastructure readiness is lower compared with others age ranges. Overall, infrastructure readiness towards ICT has a mean score of M=3.66 (SD = 0.89). This mean score indicates that infrastructure readiness towards ICT tends to be positively perceived by AEO.

Management readiness

As Table 6 illustrates, a significant difference was found between regency (F=13.78, p<.01) with management readiness. The results of post hoc analysis found significant differences (p<.05) between regency, such as between Magelang and Kulonprogo, also between Bantul and Gunungkidul. Overall, management readiness towards ICT has a mean score of M=3.69 (SD = 0.792). This mean score indicates that management readiness towards ICT tends to be positively perceived by AEO.

Besides that of farmer readiness, results of the four factors of readiness indicate a positive perception towards ICT programme implementation. By using Aydin and Tasci's (2005) assessment model, this study has evaluated whether the employees in an organisation are ready to implement ICT programmes. From the analysis, the levels of readiness are determined as depicted in Figure 1.

Based on Table 6, the mean score of overall farmer readiness M=2.45 (SD=1.006) indicates that the agriculture extension officers (AEO) perceive the farmers as being not ready for ICT implementation which suggests that further work needs to be done before the implementation of ICT programmes. On the other hand, infrastructure, personal and management readiness have mean scores from 3.4 to 4.2 and according to the assessment model. This indicates that the agriculture extension officers perceive themselves as being ready to implement an ICT programme.

Those findings answer the first research question concerning the readiness level towards an ICT programme as perceived by AEO. In addition, those results also address the third research question regarding the influence of demographic variables on ICT programme implementation.

Barriers towards ICT

The four factors of barriers towards ICT programmes were investigated, including barriers categories classified as organisational culture, individual, technological and policy barriers.

Table 7: *One-way ANOVA of barriers*

Variables	Demographic	N	Organisational culture barriers			Individual barriers			Technological barriers			Policy barriers		
			Mean	F value[a]	Post Hoc[b] Test	Mean	F value[a]	Post Hoc[b] Test	Mean	F value[a]	Post Hoc[b] Test	Mean	F value[a]	Post Hoc[b] Test
Regency	1. Magelang	77	3.70	17.64**	4>1,2,3*	3.04	29.36**	4>1,2,3*	4.11	2.43	ns	3.31	2.28	ns
	2. Kulonprogo	76	3.62			3.09			3.89			3.08		
	3. Bantul	80	3.61			2.98			3.91			3.06		
	4. Gunungkidul	79	4.34			3.84			3.88			3.27		
Gender	1. Male	247	3.78	5.11*	none	3.21	1.21	none	3.95	0.16	none	3.21	0.74	none
	2. Female	65	4.02			3.32			3.92			3.11		
Age	1. 20 – 29.99	26	4.09	1.86	ns	3.32	3.55	ns	4.04	2.61	ns	3.16	0.93	ns
	2. 30 – 39.99	39	3.73			2.99			4.17			3.00		
	3. 40 – 49.99	160	3.85			3.34			3.89			3.20		
	4. > 50	87	3.71			3.11			3.92			3.22		
Education	1. S. high school	41	3.74	0.65	ns	3.07	1.44	ns	4.06	3.03*	ns	3.20	0.21	ns
	2. Vocational	73	3.74			3.34			3.83			3.13		
	3. Bachelor	188	3.87			3.22			3.94			3.20		
	4. Master	10	3.72			3.43			4.37			3.10		
Job category	1.General	156	3.67	2.43	ns	3.05	3.86**	ns	3.97	0.33	ns	3.19	0.94	ns
	2. Plantation	23	3.69			3.53			3.94			3.47		
	3. Forestry	41	4.05			3.36			3.83			3.09		
	4. Foods crops	36	4.01			3.51			3.98			3.21		
	5. Livestock	26	4.05			3.42			3.92			3.09		
	6. Fishery	17	3.86			3.30			3.96			3.21		
	7. Contract employee	13	3.96			3.41			3.98			2.94		
Overall		312	3.82			3.24			3.95			3.18		

[a]*P < .05 and **P < .01
[b]Post hoc test Scheffe's Multiple Comparisons differences at p < .05
ns : non significant

Organisational culture barriers

As Table 7 shows the, demographic variable of regency (F=17.64, p<.01) and that of gender (F=5.11, p<.05) demonstrate a significant difference with the organisational culture barriers. The result of the post hoc test revealed a significant difference (p<.05) between Gunungkidul

and the other regencies. In the Gunungkidul regency, the perception of the organisational culture barriers is higher compared with other regencies. These findings indicate that regional differences in implementation of an ICT programme will lead to differences in the organisational culture barriers as perceived by AEO. Overall, the organisational culture barriers towards ICT has a mean score of M=3.82 (SD=0.793). This mean score indicates that the organisational culture barriers tend to be relatively high compared with other barriers as perceived by AEO.

Individual barriers

Table 7 shows that demographic variables of regency and job category reveal significant differences with the individual barriers. The results show significant differences with regency ($F=29.36$, $p<.01$) and job category ($F=3.86$, $p<.01$). The result of the post hoc test revealed significant differences ($p<.05$) between Gunungkidul and the others regencies. This finding demonstrates that in the Gunungkidul regency, the perception of individual barriers is higher when compared with other regencies. Overall, individual barriers towards ICT has a mean score of M=3.24 (SD = 0.744). This mean score indicates that individual barriers towards ICT tend to be relatively low compared to other barriers perceived by AEO.

Technological barriers

Table 7 shows that only the education of demographic variable ($F=3.03$, $p<.05$) demonstrates a significant difference with the technological barriers. In addition, the result of the post hoc test shows no significant difference among demographic variables. These findings indicate that differences between demographic variables did not influence the perception of the technological barriers. Overall, the technological barriers towards ICT has a mean score of M=3.95 (SD = 0.610). This mean score indicates that the technological barriers towards ICT tend to be relatively high compared to other barriers as perceived by AEO.

Policy barriers

As Table 7 illustrates, no significant difference was found among demographical variables when compared to the policy barriers. These findings indicate that differences among demographic variables did not influence the perception of the policy barriers. Overall, the policy barriers towards ICT has a mean score of M=3.18 (SD = 0.748). This mean score indicates that the policy barriers towards ICT tend to be relatively low compared to other barriers as perceived by AEO.

Based on Table 7, the sequence of overall mean score of barriers perceived by AEO are technological barriers M=3.95 (SD = 0.610), organisational culture barriers M=3.82 (SD=0.793), individual barriers M=3.24 (SD = 0.744) and lastly policy barriers M=3.18 (SD = 0.748). These findings indicate that an organisation must pay more attention to the reduction of technological and organisational culture barriers first when implementing an ICT programme.

Those findings reply directly to the second research question in relation to the barriers level towards ICT programmes perceived by AEO. In addition, those results also respond to the third research question concerning the influence of demographic variables on ICT programme implementation.

DISCUSSION AND IMPLICATION

ICT has tremendous potential to revolutionise the way information, knowledge and new technology is managed, developed and delivered to farmers through ICT programme implementation. Farmers need assistance from intermediaries to adopt knowledge and information. In that regard, AEO are suggested to be the effective intermediaries for delivering

information and knowledge directly to farmers. Therefore, assessment of readiness and barriers by AE is very crucial in order that ICT be implemented successfully to farmers.

The findings that answer the first research question on the readiness perceived by AEO show that three out of the four factors of readiness indicate a positive perception towards ICT programme implementation. Based on the assessment model of e-LRS from Aydin and Tasci (2005), farmer readiness has the lowest value of readiness. Thus it appears that the farmers are perceived as not ready which suggests that much more work needs to be done before they are ready for ICT programme implementation. The other readiness factors indicate that infrastructure, personal and management are perceived as ready for the implementation of ICT programmes even though some improvement was felt necessary. These findings inform the government that they must pay attention to farmer readiness before they can embark on step to implement ICT in these regions.

In response to the second research question, this study demonstrated that two factors, organisational culture and technological barriers were perceived as being relatively higher than individual and policy barriers. This suggests that the success or failure of e-Learning programmes is influenced by the interconnectedness among persons, behaviors and the environment (Mungania 2003). Organisational culture and technological barriers are related to environmental factors which influence e-Learning success. It may be difficult to completely eliminate these barriers but they definitely can and should be reduced. Mungania (2003) offers some recommendations to reduce such barriers. It is proposed that organisations must support the use of ICT by offering a supportive culture, incentives, models, resources, and fostering self-efficacy. As for barriers of technology it is proposed that organisations must improve the availability of ICT infrastructure and Internet connectivity, reduce the cost of broadband connection, navigation problems and limitations of technical support.

The third research question examined if demographic characteristics of AEO have a bearing on readiness and barriers perception. The one-way ANOVA results, particularly post hoc analysis, show that we should pay attention firstly to regency. This variable has a significant influence to all of the readiness variables, but in terms of barriers, the regency only has a significant influence to organisational culture and individual barriers. The presence of such differences may be caused by several factors. One of them is likely government policy. After the economic crisis in 1998, the Indonesian government implemented a decentralisation system which gave autonomy to the regencies (Seymori & Turner 2002). This system influences the policy of each region. Each region utilises different strategies, policies and programmes in particular to the adoption of ICT for agricultural extension. This situation affects perception of AEO in regards to readiness towards ICT programme implementation. Prior studies (e.g., Teo & Lim 2000; Young 2000; Yuen & Ma 2002; Muilenburg & Berge 2005; Joiner et al 2005; Ong & Lai 2006) have demonstrated significant difference between gender in the adoption behavior of ICT or e-Learning. Inconsistent with those studies, this study did not show gender to be a good indicator in the readiness as well as perceived barriers. Gender only has significant influence to the organisational culture barriers. This may have been caused by the unbalance sample of male and females (21% female and 79% male). The third demographic variable, the age variable, has a significant influence to infrastructure and personal readiness but has no significant influence on the barriers. Past studies have examined the effect of age differences on technology adoption (Burton-Jones & Hubona 2003; Venkatesh et al 2003; Rezai et al 2008). In line with these studies, this study also found that age as a variable may affect respondent perception towards ICT programmes. This study demonstrates that the age range < 40 years old is more positive in the perception of personal and infrastructure readiness. The other variables, such as education and job category have an influence on personal and infrastructure readiness as well as individual and technological barriers even though the post hoc test only demonstrated a difference of personal readiness on education variable. The result of post hoc test demonstrates that the higher the level of education the more positive personal readiness will be. To sum up, the information in regards to demographic variables must be considered when implementation of ICT programmes takes place.

LIMITATION AND FURTHER RESEARCH

There are several limitations in this study which should be noted. First, only one region of Indonesia was used in the study for data collection. While the study allows us to gain a greater understanding of the readiness and perceived barriers of agricultural officers towards ICT programmes, it is difficult to generalise the results to a different sample. Perhaps, different areas have different characteristics regarding farmer, infrastructure and management. Therefore, further research should be conducted in other areas in Indonesia and in other developing countries to obtain a more conclusive and generalisable result. Second, the readiness was assessed at the beginning stage for the implementation of ICT programmes; hence, further research can be conducted to assess readiness and barriers of ICT programmes after its implementation in the future to give greater stability to research findings in this area. Third, this study uses a primary research approach, so additional research designs are needed to evaluate the validity of the instruments and findings. For example, longitudinal evidence may enhance the understanding of readiness and perceived barriers towards ICT programmes.

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