The Study of Factors Influencing Computer Adoption in East Java On-Farm Agribusiness[1]

By
Sudaryanto*
School of Business University of Ballarat, Victoria, Australia
E-mail; y.sudaryanto@ballarat.edu.au
Jerry Courvisanos
Senior Lecturer, School of Business University of Ballarat
E-mail: j.courvisanos@ballarat.edu.au
Soekartawi
Professor in Brawijaya University, Malang Indonesia and Expert Staff in The Ministry of Education The Republic of Indonesia
E-mail: soekartawi@yahoo.com

Abstract

This paper seeks to investigate the factors that influence computer adoption in East Java On-Farm Agribusiness and the implications for sustainable agricultural development. A mixed method of semi-structured interviews and mail surveys was employed to maximise response rate. The conceptual framework and theoretical insights presented are based on the review of literature, with primary data collected from a broad range of agribusinesses in East Java. To develop quantitative information of sample characteristics, a multi-variate analysis has been employed. Logistic regression has also been used to test the research hypothesis. The research produced the research finding that the probability of adopting computers for agribusiness is strongly influenced by manager's age, education and gross sales. This research has direct implication on agribusiness development for East Java and other provinces in Indonesia. It aims to encourage other researchers to do benchmarking with other developing countries based on this research. The complexity and wide range of agribusinesses in East Java made the research methodology complicated. This investigation of the factors influencing computer adoption contributes to the Indonesian agribusiness model of development.

Key words: Agribusiness, ICT-computer, multi-stages sampling, logistic regression, East Java

Introduction

Since 1995, East Java has become a centre for agriculture, which includes food crops, horticulture (tree crops), livestock and fisheries. It produces about 35 per cent of the Indonesian national food supply. Some commodities such as rice, sugar cane, coffee, tobacco, rubber, cocoa and fruit are the other major agricultural products grown in the region. The province of East Java makes a significant contribution to the national economy and especially to the agro-industry

[1] This paper is presented at 21st ANZAM Conference on *Managing Our Intellectual and Social Capital*, 4-7th December 2007, Sydney, Australia. Sudaryanto would like to thank to both Dr. Jerry Courvisanos and Prof. Soekartawi for their great supervision on his theses. This paper is part of his theses in which in the whole theses discusses the ICT adoption stages. Both supervisors have been most helpful during the development and writing of this paper.

sectors in Indonesia. This is reflected by the Regional Gross Domestic Product (GDRP) of the province. During 2002, East Java's GDRP was 227.0 trillion Indonesian Rupiah (IDR) (CBS, 2002). The agribusiness sector contributed to 19 per cent of this GDRP.

In relation to the regional economy (*Otonomi Daerah*), it is important for East Java to improve regional economic growth on agricultural based businesses. Sudaryanto *et al* (2007) had mentioned that agribusiness in EJ is still very important due to: (1) being a supplier of country's main food, (2) levels of employment, (3) adding value in Gross Domestic Product (GDP) and (4) strong foreign capital inflow. This improvement of this sector can be done by increasing efficiency through the effective adoption of the most up-to-date technology. Agribusiness productivity theoretically is influenced by the three broad factors of land, labour, capital (and technology incorporated with the three factors). The widespread application by farmers of sophisticated computer technology creates efficiencies in areas such as bookkeeping, planning capital expenditures, pest control, pricing strategies and internet possibilities. In developing countries with large agribusiness sectors, these computer-based efficiencies can contribute significantly to economic development.

To support agribusiness productivity, the Indonesian government, under the Ministry of Agriculture (MOA) has been embracing many parties with the aim of increasing agribusiness productivity by mechanization and the diffusion of technology. Mechanized technology including on-field technology (tractor, breeding and harvesting machinery), and off-field technology like Computer Aided Development (CAD) have the aim of improving output value. Computerized agribusiness is expected to improve farming efficiency and effectiveness. Courvisanos' (2005; , 2007) studies on Kaleckian technological innovation and its application in Australian industry found that technical change has a significant labor saving bias when fitted into Kaleckian investment ordering model. The findings initiated this study in particular emphasises on computer adoption in East Java On-Farm Agribusiness (EJOFA).

At the first stage, digitalizing administration would be the main expectation of computerized development in order to bridge the gap of precise stocking calculation, pricing, scheduling and many other managerial aspects. Then, computer communications knowledge becomes the focus of concern in order to improve farmer's knowledge of accessing the Internet. Finally, farmers can use computers to share databases between provinces and countries, while creating world-wide networks. In developing countries, the success of Information and Communication Technology

(ICT)-computer adoption for business such as e-Choupal[2] (India) e-Perolehan[3] (Malaysia) and Asean-China ICT cooperative where agricultural database sharing programs have developed to deliver agribusiness value to world-wide customers on a sustainable basis and efficient information sharing. The unique features of agriculture in developing countries, including Indonesia, mostly are characterised by a rural base with fragmented farms, weak infrastructure and much involvement by intermediaries. These features make successful development of ICT difficult, and thus, it requires investigation into the factors influencing computer adoption. The focus of this study is to identify computer adoption in EJOFA and attempt to examine what are the major factors influencing computer adoption.

Review of the Literature

Company's characteristics

Scholars investigating computer adoption have identified that different sectors of agriculture have different preferences in adopting computer technology (Putler & Zilberman, 2001). Putler and Zilberman (2001) in Tulare County, California have shown that livestock producers are much more likely to use computers for production decisions rather than crop producers. Similar research has been done by Ernst and Tucker (2002) who found that larger farms in both livestock and crops tend to adopt computers and ICT rapidly. On the other hand, Batte (2005) identified that livestock producers spend less hours on using the computer than crop producers. Studies have also shown that the size of company influences computer adoption (Amposah, 1995b; Baker, 1992; Jarvis, 1990). Thus, the first two hypotheses to be tested are:

H1: Computer adoption is dependent on different types of agribusiness, with stronger adoption amongst livestock producers than among fisheries and crop producers

H2: Size of the business has significant influence on computer adoption in EJOFA, with stronger adoption amongst livestock producers whose farms are larger

Amposah (1995) in his research on the use of computers in North Carolina concluded that increasing farm size will encourage farmers to adopt computers. Baker (1992) in his research on factors influencing computer adoption in non-farm New Mexico agribusinesses, indicates that

[2] E-Choupal is ITC's International Business Division, one of India's largest exporters of agricultural commodities which is designed to be friendly system for Indian's farmers

[3] E-Perolehan is the Electronic procurement system of the Government of Malaysia linking trade between the government and its suppliers.

computer adoption is related to firm characteristics such as size and type of business. Similarly, Gloy and Akridge (2001), found that in large US farms, the type of the company does not significantly influence computer adoption, instead, gross sales was the major influence. This sales phenomenon may possibly be in operation in EJOFA which has similar diversity in agriculture business such as food crops, tree crops, livestock, and fisheries.

Thus, the third hypothesis to be tested is:

> *H3: Gross sales have a significant influence on computer adoption in EJOFA, with stronger adoption expected for producers.*

Organizational culture

Lim (2004) identified that cultural differences impact on online activity. The concept of culture could be individual, social and organizational (Hofstede, 1991). Individual culture is referred to power distance, uncertainty avoidance, individualism and collectivism, masculinity and feminist and also short and long term orientation. Whilst organizational culture comprises the attitudes, experiences, beliefs and values of an organization. Individual culture can affect organizational culture when it deals with the leadership of owner/manager or the decision-maker in the companies. The individual factors such as gender, ethnicity, family relationship and export orientation and race have been shown by Gloy and Akridge (2001), and Putler and Zilberman (2001) to result in strong computer adoption.

East Java culture has an explicit collectivist open minded approach, mostly dominated by Maduranese and East Javanese ethnic. It is potentially producing positive responses towards new technological/mechanization of agribusiness. Some scholars have analysed ICT literacy[4] and company's business orientation as part of organizational culture (Batte, 2005; Mbowa & Mugisha, 2004; Putler & Zilberman, 2001; Salampasis, Batzios, Samathrakis, Adroulidrakis, & Adroulidraki, 2002). Mbowa and Mugisha (2004) did not involve race as an explanatory variable, but rather examined ICT literacy of business operators and found that this variable has contributed significantly to computer ownership. The other organizational cultural factors in agriculture sector were related to small and medium business (business oriented); family relationships and association membership (collectivism). This is in contrast to Hofstede theory (1991, p. p.5) has mentioned on individualism rather then collectivism where people in a culture prefer to act as individualist. Managers involvement has also been shown to influence computer

[4] ICT literacy refers to an ICT ladder with the lowest level being conventional ICT like telephone (very weak) to e-business (very strong). The ladder is presented in a figure from Sudaryanto *et al* .(2007).

adoption (Jarvis, 1990). In small and medium businesses, managers mostly are the owner of the business; while in large businesses, the managers are the decision-maker. The manager's knowledge on ICT and how to use it is affected significantly the level of computer adoption in the business. This leads to another three hypotheses that identify positive engagement with computer adoption which need to be tested:

H4: More family membership in companies the more significant influence on computer adoption in EJOFA

H5: More companies being in association membership the more significant influence on computer adoption in EJOFA

H6: More managers having ICT-computer knowledge the more significant influence on computer adoption in EJOFA

H7: More managers used their ICT-computer knowledge for business the more significant influence on computer adoption in EJOFA.

Demographic characteristics

East Java farmers are assumed to be quick adopters of new technology that could potentially improve productivity. However, the influence of owner manager demographic characteristics needs to be investigated. Putler and Zilberman, (2001), Batte (2005) and Salampasis *et al.*,(2002), Mbowa and Mugisha (2004) and also Ernst and Tucker (2002) point out that the demographic characteristic of owner manager significantly influences ICT-based computer adoption.

The demographic characteristic in most research tracks the influence of core variables. Thus, race, age, gender, income and education are most cited as "classic adopter" variables (U.S. Doc, 2000 in Ernst and Tucker 2002). Ernst and Tucker (2001) found that age, economic factors and education did not influence adopter status in the fruit and vegetable industry, however, gender was statistically significant. Other scholars mentioned that manager's education level significantly influences computer adoption (Amposah, 1995b; Batte, 2003; Jarvis, 1990).

In terms of the manager's age, Putler and Zilberman (2001) have argued that age has a significant effect on computer adoption. The pattern of adoption increases up to the age group of 36–40, after which, adoption begins to decrease with age. In the current study, the demographic characteristics of managers are identified as age, gender, and education. While Batte (2003) found that farmers who work in a large farm have a higher education level and tend to use computers due to the higher competition. Contradictory research by Jarvis (1990) on research in non-farm

New Mexico agribusinesses, indicates that computer adoption was unrelated to manager characteristics, including age and education. This leads, finally, to another three hypotheses that need to be tested:

H8: A*ge 41+ has significant influence on computer adoption in EJOFA*

H9: Gender has significant influence on computer adoption in EJOFA

H10: Manager's education has significant influence on computer adoption in EJOFA

Methodology

This research was conducted based on an explanatory research design. Explanatory research can be defined as a method or style of research in which the principal objective is to know and understand the trait and mechanisms of the relationship and association between the independent and dependent variable (Veal, 2006). In explanatory research, investigators attempt to test the hypothesis based on some previous study. The focus of the study was to identify what factors have the most significant influence on the decision-making process of ICT-computer adoption and to what extent farmers use computers for value creation. Since the outcome variable was dichotomous, a binary logistic regression model was used.

a) Sampling frame and sampled population

The study's sample comprised 178 on-farm agribusiness (agro industry) owner managers from four agricultural areas (horticulture, fisheries, livestock and crops) in the East Java province. There are 29 counties and eight municipalities, and two administrative cities in East Java. From these counties, a multi stage sampling method was used for parsimonious reasons. The target population in the first stage referred to East Java's economic development planning document. which divided the region into four clusters: (1) North-South Bank (*Koridor Utara Selatan*) includes Gresik, Surabaya, Sidoarjo, Mojokerto, Pasuruan, Malang, Blitar. (2) Nort-West Bank (*Koridor Barat Daya*) includes Jombang, Kediri, Tulungagung, Trenggalek, Nganjuk, Madiun, Ponorogo, Pacitan, Magetan. (3) East Bank (*Koridor Timur*); Probolinggo, Situbondo, Bondowoso, Lumajang, Jember, Banyuwangi (4) North Bank (*Koridor Utara*); Lamongan, Tuban, Bojonegoro, Ngawi, Bangkalan, Sampang, Pamekasan, Sumenep.

Two clusters chosen conveniently were North-South Bank and East Bank, in which are established four big universities: University of Airlangga (UNAIR), "Institut Technology of Sepuluh Nopember" (ITS), Brawijaya University (UNIBRAW) and University of Jember (UNED). All four universities have their responsibility to improve agribusiness performance and

ICT adoption as part of “Three Points University’s responsibilities” called “Tri Dharma Perguruan Tinggi” in which it involves the public services, teaching and research.

The second stage involved choosing randomly two counties within these two clusters. For the East Bank Cluster, the chosen counties were Banyuwangi and Jember while in the North-South Bank Cluster the chosen counties were Malang and Sidoarjo. Among the four counties, the first three have a variety of agricultural products. The on-farm agribusiness population in the four areas is 272. That number is based on agro industry database which is published by The Ministry of Agriculture 2003. The database comprises the directory of Indonesian Agro Industry (on-farm agribusiness) from micro business scale with less than 5 employees to large business with more than 100 employees. In this study exclude the micro business respectively as they do not have a business plan and profit oriented.

The third stage was designed to obtain a 10 per cent quota from each area and each type of business in order to ensure cross section data was regress-able. The total sample had 200 respondents. The response was 178 (or 89 per cent) from the sample population with the distribution presented in the following Table 1.

Table 1. The Valid Response Distribution per Types of Business in Selected Counties

		Address				Total
		Jember	Banyuwa-ngi	Malang	Sidoarjo	
Horticulture	Count	20	11	16	9	56
	% within type of business	35.7	19.6	28.6	16.1	100
Fisheries	Count	18	13	19	16	66
	% within type of business	27.3	19.7	28.8	24.2	100
Livestock	Count	12	7	11	2	32
	% within type of business	37.5	21.9	34.4	6.3*	100
Crops	Count	7	7	6	4	24
	% within type of business	29.2	29.2	25.0	16.7	100
Total	Count	57	38	52	31	178
	% within type of business	32.0	21.3	29.2	17.4	100

* Quota target was not achieved due to low responses

b) Data collection and analysis

A survey questionnaire was designed for this study to measure the key constructs relating to the research hypotheses. The questionnaire was developed by the researchers and distributed to the agricultural managers one by one. A pilot survey was done to test the questionnaire. The survey was carried out in the combined method of mailed and semi-structure interview in order to maximise the response rate. The data collection phase was conducted between July and October 2006 in East Java. Ten trained final-year students were employed under tight supervision and attached to one county to obtain the primary data.

Students knocked on the door one by one and made an appointment first with the owner/manager. When the respondent did not have time to be interviewed, the interviewer would let the owner/managers fill in the questionnaire at their own discretion. The instructions to complete the form were explained on each section of the questionnaire. After two weeks, the students would collect the questionnaire from the owner/managers. This technique counted for 65 per cent of the total response. The rest (35 per cent) had been investigated by the interviewers by asking the managers whether they had time to be interviewed. When a time was arranged that the managers were ready, the interviewer would then ask them to respond to the questions.

c) The Questionnaire

Using a combination of open and closed questions, the questionnaire was divided into four sections: (1) the organizational culture, (2) owner/manager's demographic details and (3) company profile. The open questions are related to the sales volume of the company for the last financial year (2005) and the age. The closed questions are related to two sections designed to gather information about organizational and managerial characteristics. These closed questions were coded as categorical data. This information was then used to investigate the factors which influence EJOFA computer adoption. The specific measures used within the instrument are explained later in the paper.

The Analytical Model

a) Logistic Regression Model

Logistic regression (Logit) is a statistical tool as part of the statistical models called Generalized Linear Models (GLM) which produces predictive equations. Logit allows for prediction of discrete outcomes - which are mostly dichotomous as a dependent variable - with a

set of various types of independent variables - such as continuous, discrete, dichotomous - taking on two or more possible values (Hosmer & Lemeshow, 1989, p.1). Logit becomes the alternative choice of statistical tools to solve the problem of dichotomous variable instead of grouping factors using analysis of discriminant. The research that has been done by Pohlmann (2003) recommended that logistic regression should be the model of choice for binary dependent regression analysis.

In this research we use Logit model in which one or more independent variables are binary (or dummy) (Hosmer & Lemeshow, 1989, p.1.; Kmenta, 1971, p. 425). The following model is the Logit equation for the research. The Logistic regression model will be such as follow:

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_{1_i}\chi assoc + \beta_2\chi family + \beta_3\chi involved + \beta_4\chi literacy + \beta_5\chi gender +$$
$$\beta_6\chi age + \beta_7\chi edu + \beta_8\chi types + \beta_9\chi class + \beta_{10}\chi \log sales + \varepsilon_i$$

Where *ln* is natural logarithm, *p* is the probability of adopting computer; β_0 is constant value, β_i are parameters to be estimated; $y_i = \left(\frac{P}{1-P}\right)$ is dependent variables on ICT adoption that takes on a value of yes=1 if the respondent adopt computer or 0 if otherwise. X*assoc* is the dichotomy variable (1/0) of group membership of the companies, X*family is* dummy (1/0) variable of employees family relationship (<%), X*literacy* is the scale variable of ICT literacy of the manager and employees (1= very weak, 5 = very strong), X*involved is binary* (1/0) variable of manager's involvement in daily activities, X*gender* is the dichotomy variable (1=male, 2= female), X*age* is the dummy variable (1/0) with reference category age 41+, X*edu* is dummy variable (1/0) of education of the manager with reference category TAFE[5], X*types* is four types of business (categorical), X*class* is dummy variable (1/0) with reference category large business, *Xsaleslog* is log10 of gross sales volume the last semester (continuous), ε is assumed to be standard normal.

b) Expected Output

The expected value of the analysis is simply the probability (p) that the response variable is one (i.e. the probability of computer adoption). The explanatory variables will produce the

[5] TAFE in Indonesia is equal to D1 (one year), D2 (two years), D3 (three years) enrolled in undergraduate program

significant probability on influencing computer adoption. Therefore Logit will test the following hypothesis:

Accept H_a *if 05 with the lowest level of significant 95%* (Phillip, 2003)

Exploratory data analysis (EDA) was conducted to test skewness, kurtosis and data distribution of continuous variables. This analysis identified the need to normalise responses concerning both sales volumes and ICT literacy variables. This transformation was done by squaring data with negative skewness and logging variables which exhibited positive skewness.

Research Findings and Discussion

a) Factors Influencing ICT Adoption

In order to obtain an initial insight into the structure of the collected data, bivariate analysis was undertaken to explore the relationship between the explanatory variables and computer adoption. This analysis is presented in Table 2 below. The result of the bivariate analysis found a significant association between the owner/manager's age and computer adoption (x^2 = 5, df =2, $p<.05$). The term 'computer' as a Portable Computer (PC) does not seem to attract younger managers. This is associated with the research finding of Putler and Zilberman, (2001) and Batte (2003). Computer adoption tends to be accepted in the range of 41-50 (27.9%). The rest do not adopt computers, with the next highest percentage in the age range of 21-40 (92.6%).

Education level indicated for having significant relationship with Computer adoption (x^2= 5, df = 1, p< .01). TAFE level is the highest probability association. Higher than TAFE level of education of the manager was not likely to result in more computer or PC adoption. This figure supports research findings by Amposah (1995b), but against Batte (2003) and Jarvis (1990). The education level of managers has relevancy with ICT literacy in which it has a mean value 2.81 (3 = average) and skewness -.188. While gender is likely associated with ICT-computer adoption (x^2 = 5, df = 1, p < .05) and dominated by female with CI 95% (.001). This figure contradicts research findings by Brown (2005) that there were no significant gender differences on using ICT-computer for internet banking.

In relation to organizational culture, the term "individualism" as defined by Hofstede (1991) did not apply in EJOFA. The agribusinesses tend to act collectively rather then acting individually on computer adoption with family relationship being significant (x^2= 5, df = 3, p < .01). The highest percentage belongs to family relationship of the employee with between 21-30%. It

supports Jarvis (1990) research finding that the decision on adopting computers is associated with action of peers and family. Also, manager's involvement on the field indicated a significant association with computer adoption (x^2= 5, df = 1, p < .05). This figure supports Batte (2003), whose research finding was that manager's involvement influenced ICT–computer based adoption. In contrast, an association membership such as agricultural cooperatives field-farmers association did not have any connection with ICT-computer adoption.

Table 2. Factors Influencing Computer Adoption

Managerial/organizational	**Computer Adoptions**		**Statistics**	
Characteristics	**Yes**	**No**	**Df**	**P-value**
Age 51+	15.1%	18.2%		
41-50	87.2%	64.2%	2	.022*
21-40	7.7%	17.5%		(Pearson X ²)
Family relationship : <10%	5.1%	33.68%	1	.000*
10-20%	43.6%	42.3%		(Fisher exact test)
21-30%	17.9%	7.3%		(a)
>31%	33.3%	16.8%		
Education:	32.4%	36.4%	1	.000*
Secondary/college	81.3%	18.8%		(Fisher exact test) (b)
TAFE	21.7%	78.3%		
Bachelor	4.4%	95.6%		
Master+				
Gender: Male	15.9%	84.1%	1	.001*
Female	43.6%	56.4%		(Fisher exact test) (c)
Association membership				
Yes	18.5%	81.5%	1	.258
No	23.9%	76.1%		(Pearson X ²)
Class of Business: Large	21.0%	79.0%	2	.019*
Medium	30.0%	70%		(Pearson X ²)
Small	3.7%	96.3%		
Types of Business				
Horticulture	21.4%	78.6%	3	.934
Fisheries	24.2%	75.8%		
Livestock	18.8%	81.3%		
Crops	20.8%	79.2%		
Involved: Yes	19.3%	80.7%	1	.003*
No	63.6%	36.4%		(Fisher's exact test) (d)

Companies' characteristics, especially class of business, is indicated in the results that there is significance in association with computer adoption with significant value (x^2= 5, df = 2 p< .05). It supports Jarvis (1990), Baker (1992) and Amposah, (1995) on their research findings mentioned that either types or size of business influenced computer adoption. One way ANOVA test shows that sales volume has significant different with computer adoption ($p<0.05$) while ICT literacy

does not significantly differ (p>0.05). Table 3 presents the result of the test. The sales volume was transformed into log 10 to smooth the data.

Table 3. Result of One Way ANOVA for continuous and ordinal Variables

Variable	Computer Adoption (Yes)	Computer Adoption (No)	P-value
Sales volume: (in million rupiahs)	924.340 (2,920.284)	6,972.774 (1,155.577)	0.005
ICT literacy	2.95 (.090)	2.77 (.072)	0.212

b) Binomial Logistic Regression Result

Results from the Binomial Logit model (see Table 4 below) show that 80.4 per cent of all the farmers were predicted correctly not to adopt computers with the odd successful prediction that would be significant (p=0.00). It means that the probability of adopting computers is not fully supported by each of the explanatory variables individually. Seven of the ten variables: types of business, gender, literacy, involved, association, family3, and DM3class as a dummy variable of a large size business are not likely significant predictors of whether farmers would adopt computers.

The remaining three significant predictors are - saleslog, 41+ age (dummy variable) and TAFE - have the possibility of individually supporting computer adoption. It can be seen that the Omnibus Test of the Model; that when we consider all ten predictors together, the model or equation is significant (X^2 = 61.958, df = 12, p <.001). From the estimating percentage of variance accounted for, the Nagelkerke R squared indicates that approximately 53 per cent of the variance mentioned whether or not farmers adopt computer can be predicted from the linear combination of the ten factors.

The Logit results found that sales volume significantly influenced computer adoption less than <0.05 with the odd ratio being .266 (0.104-0.680) accept *H3*. It means that increasing saleslog will reduce adopting computers by 0.226 times. It supports the research findings of Mbowa and Mugisha (2004). On the other hand, types of business and class/size of business with reference category large businesses indicated no significant influence on ICT adoption (reject *H2)*. It means that increasing either the types or size of business will not influence computer adoption (reject *H1)*. Also, manager's increasing involvement did not significantly influence computer adoption (reject *H7)*. The family membership (reject *H4)* and association membership (reject *H5)* also did not have significantly influence. This means that any increasing number of employees

with a family relationship and any increasing number of association memberships will not influence computer adoption. It contrasts with the research findings of Jarvis (1990).

Table 4. Logistic Regression Predicting ICT Adoption

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
							Lower	Upper
logsales1	-1.325	.479	7.644	1	.006	.266	.104	.680
Ages 41+	1.642	.808	4.125	1	.042	5.165	1.059	25.186
Large Size	-.119	1.286	.009	1	.926	.888	.071	11.033
TAFE	3.613	1.044	11.970	1	.001	37.093	4.789	287.278
family3	-.024	.026	.844	1	.358	.976	.927	1.028
Types			6.957	3	.073			
Horticulture	1.580	1.159	1.860	1	.173	4.855	.501	47.021
fisheries	.005	1.074	.000	1	.997	1.005	.122	8.240
Livestock	-.916	1.391	.434	1	.510	.400	.026	6.113
Association	1.012	.685	2.184	1	.139	2.752	.719	10.534
Male	.955	.669	2.039	1	.153	2.598	.701	9.631
Literacy	.917	.506	3.275	1	.070	2.501	.927	6.748
involvement	-.249	1.466	.029	1	.865	.780	.044	13.782
Constant	-3.938	2.911	1.831	1	.176	.019		

(a): Variable(s) entered on Step 1: logsales1, DM_41, DM3class, DMEd2, family3, TYPES, ASSOC, GENDER, Literacy, INVOLVED.

Gender (sex) does not significantly influence computer adoption in EJOFA (reject *H9).* This finding supports Brown and Buys (2005). On the other hand, the dummy variables of manager's aged 41+ has significant influence on computer adoption ($p<0.05$) with the odd ratio 5.165 (1.059-25.186) accept *H8*. It means that any improvement of manager's age will improve the odds value of adopting computers by 5.416 times. This finding is against Baker (1992) research findings, but it supports Putler and Zilberman (2001) and Amposah (1995a) discoveries. Manager's education (DMEd2/TAFE) has significantly influence on manager's decision-making in relation to adopting computers ($p<.005$) with odd value 37.093 (4.789-287.278), accept *H10*. It means that increasing farmer's education up to TAFE the odd of correctly estimating farmers who adopt computers increase 37.093 times. This finding contradicts Jarvis's (1990) research conclusion but supports research finding by Amposah (1995a) and Batte (2003). Finally, increasing ICT literacy did not significantly influence computer adoption on 95 per cent CI (reject *H6).*

Conclusion and Research Implications

The study shows that use of computers creates many benefits for on-farm agribusiness in East Java. Bi-variates cross tabulation analysis had shown that all the variables are significantly associated with computer adoption, i.e. the variables: age, family relationship, education level, gender, class and type of business, sales, and association membership, ICT literacy, and manager's involvement in the field. When these results were cross-checking with multi-variate analysis on a 95 per cent CI then three variables: education, age 41+ and sales could be accepted as hypotheses that they had a significant influence on computer adoption. This suggests that the role of most of the variables in the literature is overstated.

Based on the results above, we recommend that the education level of owner/managers should be increased up to TAFE level, and the age category 41+ should be paid more attention in order to increase the probability on adopting computers. On the other hand, ICT-computer literacy skill did not play an important role on adopting computer. It can be interpreted in two different ways. Firstly, those two categories (TAFE level and age's 41+) had enough computer skill for basic requirements. Secondly, that the owner/manager can do outsourcing or hire employees who have computer expertise. The sales volume negatively influences computer adoption. It is not recommended that farmers should increase their sales volume in order to be able to adopt computers.

Further research on identifying the value addition such as calculating the efficiency effect of adopting ICT either among types of agribusiness or size of business is strongly recommended. Further empirical research design with a panel data collection method will provide more information on value creation through ICT adoption.

References:

Amposah, W. A. (1995a). Computer Adoption and the Use of Information Services by North Carolina Comercial Farmers. *J. Agri and Applied Econ, 27*(2), 565-567.

Amposah, W. A. (1995b). Computer Adoption and the Use of Information Servives by North Carolina Comercial Farmers. *J. Agri and Applied Econ, 27*(2), 565-567.

Baker, G. A. (1992). Computer Adoption and Use by New Mexico Nonfarm Agribusiness *American journal of Agr. Econ., 74*(3), 737-744.

Batte, M. T. (2003). *Computer on Ohio Farms: How Used and How Usefull?*

Batte, M. T. (2005). *Changing Computer Use in Agriculture*. Paper presented at the Conference Name|. Retrieved Access Date|. from URL|.

Brown, I., & Buys, M. (2005). *A Cross-Cultural Investigation into Customer Satisfaction with Internet Banking Security*

Paper presented at the SAICSIT.

CBS. (2002). *Statistical year book of Indonesia 2002*. Jakarta: Central Bureau of Statistics Indonesia.
Courvisanos, J. (2005). Technological Innovation: Galbraith, the Post Keynesians and a Heterodox Future. *Journal of Post Keynessian Econmics, 28*(1), 83-102.
Courvisanos, J. (2007). The Dynamics of Innovation and Investment, with Application to Australia 1984-1998 In R. Holt & S. Pressman (Eds.), *Empirical Post Keynessian Economics: Looking at the Real World* (pp. 141-177). Armonk: M.E. Shape.
Ernst, S., & Tucker, M. (2001). *Perception and Adoption of Information Tecnologies: Implication for Ohio's Producer industry in the New Economy*. Paper presented at the Conference Name|. Retrieved Access Date|. from URL|.
Ernst, S., & Tucker, M. (2002). *Agri-Culture; A new Look at Adoption and Diffusion of Information Technology*. Paper presented at the Conference Name|. Retrieved Access Date|. from URL|.
Hofstede, G. (1991). *Culture and Organization*. London: McGraw-Hill.
Hosmer, D. W., & Lemeshow, S. (1989). *Applied Logistic Regression*. New York USA: John Wiley and Sons.
Jarvis, A. M. (1990). Computer Adoption Decision-Implication for Reseach and Extension: The Case of Texas Rice Producers. *American journal of Agr. Econ., 72*(5), 1388-1394.
Kmenta, J. (1971). *Elements of Econometrics*. New-York: The Macmillan Company.
Lim, J. (2004). The Role of Power Distance and Explanation Facility in Online Bargaining Utilizing software agents *Journal of Global Information Management, 12*(2), 27-43.
Mbowa, S., & Mugisha, J. (2004). Determinants of Use of Information Technologies by Agribusiness Firm in Uganda. *EAJRD, 20*(December 2004), 3-11.
Phillip, N. E. (2003). Those Most Likely: Identifying Food Processing Firms With export Potential. *Agribusiness Review, 11*.
Pohlmann, J. T. (2003). *A Comparison of Ordinary Least Square and Logistic Regression*. Paper presented at the Conference Name|. Retrieved Access Date|. from URL|.
Putler, D. S., & Zilberman, D. (2001). Computer Use in Agriculture: Evidence from Tulare County, California. *American journal of Agr. Econ.*(2001).
Salampasis, M., Batzios, C., Samathrakis, V., Adroulidrakis, S., & Adroulidraki, M. (2002, 21-22 June). *Identifying Use and Impact of the Internet Greek Agricultural Sector: preliminary Result of A Survey of websit Owners.* Paper presented at the HAICTA, Athens.
Tucker, R. B. (1998). Innovation: The New Core Competency. *Strategic and Leadership, 29*(1. 2001), pp.11-14.
Veal, A. J. (2006). *Research Method for Leisure and Tourism: A Practical Guide*. Harlow, England: Prentice Hall/Pearson Education.