

Is ICT Adoption for Agriculture Still an Important Issue?

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Abstract

Attempts to understand and improve the effectiveness of ICT Adoption for Agriculture have been at the forefront of national and regional policies ever since computers became available for agricultural management and production. EFITA* has been sharing these efforts via its conferences and the collection of data sets to identify ICT Adoption constraints and trends over time. The 5th EFITA/WCCA conference hosted in Villa Real, Portugal addressed the results emanating from these data sets and the ongoing Adoption efforts. It evaluated them via a plenary discussion of the question: Is ICT Adoption for Agriculture Still an Important Issue? The overwhelming response from conference participants asserted that ICT Adoption for Agriculture and Rural Development remains a major national and international concern. It was suggested that if cost is eliminated as a constraint the other ICT adoption impediments, in both developed and developing countries, are basically the same. Training, as one example was identified as a common, dominant alleviating adoption factor. Public funding to promote ICT Adoption and services was justified with qualifications. It was observed that ICT Adoption for Agriculture should be considered as an issue of public concern beyond farmer's interests. The EFITA sponsored data sets support some of the conference conclusions.

*EFITA European Federation for Information Technology in Agriculture, Food and Environment

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Background

Attempts to understand and explain the mechanism and constraints of Technological Innovation Adoption are not new – e.g. Grilliches (1957). Adoption of ICT (Information and Communication Technologies) in rural areas as a unique challenge has long been a specific public concern with regional, national and international strategic significance. Gelb, Schmidt and Rauschkolb (1985) focused as a case study on Extension as did an EU sponsored workshop Gelb, Bonati (1997). Harsh (1986) generalized ICT Adoption trends in Agriculture. They were later evaluated via an EFITA sponsored questionnaire since the 1999 EFITA Conference in Bonn Gelb, et al (2004). The USDA Computer Ownership and Use Surveys NASS (2005) highlight as a comparative baseline the significance of ICT Adoption constraints since 1997 for a very large sample of US farmers.

With this indicative, intensive history of effort and studying ICT Adoption issues in mind the EFITA/WCCA 2005 conference deliberated a specific question: Is ICT Adoption in Agriculture and Rural Development still an Important Issue? The conference's two dedicated sessions and plenary discussion participants had access to additional background material. It included the conference papers, the ongoing analysis of the previous EFITA Questionnaire data sets, several ICT Adoption in Agriculture perspective reviews (currently freely available at <http://departments.agri.huji.ac.il/economics/gelb->

main.html), proceedings from earlier EFITA, GIL, WCCA, AFITA, ASAE conferences and the earlier reports from the EU sponsored EUNITA project.

Participants in the discussions included experienced ICT professionals with perspectives from their respective proficiencies, countries and participation in numerous international programs dedicated to study, develop and facilitate ICT Adoption in agriculture. Discussion, questionnaire and conference participants came from: Austria, Algiers, Belgium, Brazil, Canada, Czech Republic, Chile, China, Columbia, Cyprus, Denmark, Estonia, FAO, Finland, France, Germany, Greece, Holland, Hungary, Iran, Ireland, Iran, Israel, Italy, Japan, Korea, Latvia, Lithuania, Mexico, Morocco, Norway, Poland, Portugal, Slovakia, South Africa, South Korea, Spain, Sweden, Thailand, Turkey, UK, USA and Venezuela. The full conference program can be accessed at www.agriculturadigital.org/efitaandwcca2005/docs/efita_wcca_2005_program.pdf

Conference discussion results

The conference consensus indicated that despite abundant experience with ICT initiatives and programs ICT Adoption remains a major issue and current critical concern. This is in tune with the most recently released NASS (2005) Survey. Following are some of the major ICT adoption constraints and observations emphasized during the Conference presentations and discussions:

- a. If ICT cost and infrastructure as constraints are neutralized developed and developing countries face identical problems in developing and adopting ICT for Agriculture and Rural Development. This regardless of “digital divide” definitions, generation divides, digital immigrants/natives and/or “divide” definition components;
- b. Significant “wrong” (non-optimal) ICT development and implementation decisions are prevalent. They are extremely costly in economic and scarce human capital terms. Not least - they are continuously resulting in considerable loss of benefit and opportunity;
- c. “End Users” are the key factor in defining the needs and critical success factors for ICT development and implementation. “End User” lack of ICT awareness does not seem to be a significant impediment while lack of their involvement is. “End User” complaints of “ICT related waste of time” seem to be diminishing in importance as an adoption constraint;
- d. The constant oversupply of ICT innovations and cost reductions blended with the ever changing information and Internet characteristics emphasize the critical need for an “ICT Intermediary” and training. This can be provided by an Extension officer, scientist, consultant, etc. In this situation proficient End Users are becoming an influential source of innovation and information. Their role as “agents of change” is becoming indispensable. A lack of “between End User” information exchange and “training” were indicated in this context as effective adoption impediments.

e. ICT spillovers are a main consideration in ICT becoming an enabling factor for agriculture and rural community viability. Lack of potential spillover benefits can be an ICT Adoption constraint suggesting a two to three tier “cause and effect” sequence.

f. ICT adoption in rural areas is now not only a “farmer” and agricultural concern. Recognition of this reality will determine the role and magnitude of public involvement and funding of ICT development and services for rural regions and communities as well. Consequently the targeted “agent of change” may not be the “innovative farmer” and the target function may not focus on maximizing agricultural output.

EFITA Conference conclusions and Questionnaire results

The EFITA sponsored ICT Adoption questionnaire methodology and results to date are detailed and summarized in Gelb et al. (2004). The following countries were represented in the latest 5th EFITA/WCCA Conference questionnaire data set. Of these an * indicates “New” questionnaire participants: Austria*, Brazil, Canada*, Czech Republic, Chile*, China*, Columbia*, Denmark, FAO*, France, Germany, Greece, Holland, Hungary, Iran*, Ireland, Israel, Italy, Japan, Mexico*, Morocco*, Norway, Poland, Portugal, Slovakia*, South Africa, South Korea*, Spain*, Sweden, Turkey, UK and the US. (*Austria, Canada, Finland, Lithuania and Slovenia* replies were represented in either Montpellier and/or Bonn but not in Debrecen).

The introduction of 11 “new” participating countries may suggest inconsistency within the data sets over time. This in turn might distort or bias evaluating them. The countries can however be considered to be similar enough to support broad trend comparisons over time. Specifically the data sets are sufficiently indicative in representing the past eight year period – 1998 till 2005 inclusive. Comparisons between the Debrecen EFITA Conference (2003) and Villa Real (2005) data sets should be considered as “short term” trends; Comparisons between the Bonn EFITA Conference (1998) and Villa Real data sets represent a “longer term” trend - sufficiently reflecting the recent major ICT innovation adoption trends in agriculture. “Innovation” which results from higher quality infrastructures, more sophisticated hardware and software, increased ICT awareness, farmer proficiency and involvement, improved ICT human engineering, farmer and extension interaction with ICT and each other, ICT generated benefits and more.

It must be noted that the data sets are small and do not represent farmer opinions. Representation of the replies as percentages in the tables makes comparisons easy but can be misleading. Caution in interpretation of the results is strongly advised.

a. Is ICT uptake a problem?

Table 1 confirms the conference consensus that ICT Adoption is indeed a problem. Close to 90% of the replies in Villa Real, from almost all countries, indicate that the uptake of ICT in Agriculture is a problem. Comparison with the Montpellier data set unequivocally shows that the problem has not abated over time. The NASS 2005 survey results corroborate this finding over time see - Fig.1 below.

Table 1 details this finding by attempting to differentiate between the uptakes of various computer supported technologies. The Villa Real results should be read as follows: 31%

of the replies indicated that there is a problem with the uptake of DSS, as expressed by replies representing 51% of the participating countries, etc. Accordingly the Villa Real data set suggests that close to half the participating countries indicated a problem with Decision Support Systems, Precision Farming, Production Models, Internet and e-Commerce. Comparison with the Debrecen data set suggests that this is a short term improvement. The improvement might have been even more pronounced had the Villa Real data set been confined to the Debrecen questionnaire participants. This comment can be disregarded by comparing the Montpellier EFITA Conference (2001) data sets to the Villa Real data sets over time. It indicates an overall improvement in all categories – both in the “Yes” replies and countries replying. The fact that the categories received less than 30% affirmative replies in Villa Real supports this observation.

Table 1. Summary of Debrecen and Villa Real replies related to ICT uptake problems

<i>Montpellier Replies</i> (n=65) <i>Countries</i> (n=25) <i>Debrecen Replies</i> (n=51) <i>Countries</i> (n=22) <i>Villa Real replies</i> (n=62) <i>Countries</i> =32	Montpellier 2001		Debrecen 2003		Villa Real 2005	
	% Yes	% of countries	% Yes	% of countries	% Yes	% of countries
Do you think that there are problems with the uptake of ICT in agriculture?	52.3	72.0	72.5	86.3	88.5	96.7
<i>Do you think there are unique uptake problems with the following technologies?</i>						
Decision Support Systems (DSS)	50.7	80.0	47.0	72.7	31	51
Management Information Systems (MIS)	32.3	60.0	27.4	45.4	22	36
Internet	33.8	56.0	29.4	50.0	26	43
Precision Farming	47.6	60.0	37.2	68.2	28	46
GIS	-	-	31.4	40.9		
Process Control	24.6	56.0	21.6	31.8	18	30
Production Models	49.2	72.0	35.3	59.1	26	43
E-commerce	46.1	76.0	39.2	50.0	27	44
Distance extension			21.6	36.4		

b. What is limiting the use of ICT?

Table 2. addresses ICT Adoption constraints and their relative impact over time – in this case over the 1998 – 2005 period covered by the questionnaires. The first glaring indication is that lack of effective Training is the major ICT Adoption constraint. Although this result is counter intuitive it supports the conference perception that ICT Adoption is a major problem. It is puzzling considering the fact that ICT proficiency has improved over time as indicated in Table 1. as have the magnitude and quality of “Training” efforts worldwide. This is compounded by the fact that ICT human engineering has improved, there is an influx of younger, computer literate farmers and

those in the field have gained considerable ICT experience. Never the less this result is explained in Table 2 by the increase in the “Inability of farmers to use ICT”; an increase in ICT sophistication re “Too hard to use”; close to a third of the farmers considered to be failing to “perceive economic or other benefits”; by “personal impediments” – mainly individual skills and finally the fact that there is a technology push situation characterized by “Poor integration with other farm systems”.

The intuitive assumption that farmers are more aware of the economic benefits from using ICT is supported by a considerable change since Debrecen in the “Yes” replies from most of the countries. The large increase of “Yes” replies for lack of infrastructure can probably be explained by increased expectations – e.g. for broadband and service reliability, with a relatively low percent of countries indicating this constraint. Cost as an impediment has diminished considerably since Debrecen in most countries.

Several results seem insignificant in comparing the results of Villa Real and Debrecen. “Lack of fear”, “Do not understand the value of ICT”, “Unuseful information/irrelevant problems” and “Better Alternatives” are in this category. The first two can probably be accepted at face value as minor ICT Adoption constraints. The “Better Alternatives” constraint is most probably under represented due to the fact that outsourcing is evermore prevalent supplemented by availability of ICT services by farmer and regional organizations such as packing houses, marketing facilities, etc. The “Un-useful information and irrelevant problems” replies suggest that the ICT market offers available solutions which are not always what the farmer needs. Consequently these last two constraint categories should probably be refined and studied more closely. Their impact can possibly be very significant – certainly in the near future.

“Other” constraints were identified in the Villa Real data set as: Lack of trust in ICT; Language; Quality of Extension; Lack of Extension’s “Conviction”; Inadequate support by a farmer’s organization; lack of broadband; ICT availability but lack of access and reluctance of farmers to change. “Others” mentioned in the Montpellier and Debrecen replies were: inadequate assistance in implementation; farmer traditions; farmer age; type and size of farm; ICT is not dependable; lack of managerial experience and no connection to research. Language was mentioned in Debrecen twice and in Villa real three times.

Looking at these results over time the Villa Real result for “Inability of farmers to use ICT” is similar to the result of eight years ago, albeit for fewer countries in 1999 and a lower result for ICT being “Hard to use”. “Perception of economic benefits” remains the same as eight years ago but for significantly less countries. Personal impediments become a dominant factor over time as is the inability of ICT developers to integrate ICT into existing systems. “Lack of time” as a constraint which featured prominently in the Debrecen data set seems to have been resolved. This may be the result of outsourcing, recognition that ICT is not necessarily a “time saver” and improved ICT human engineering. Cost as an impediment has diminished since Debrecen to the 1999 Bonn significance. This can be interpreted to reflect cost reductions in hardware and software, farmers’ ability to buy only what they need and competition between suppliers – all in most of the participating countries.

Table 2. What are the factors limiting the use of ICT by farmers?

<i>Limiting factors</i>	Bonn 1999 n=58 countries=25			Montpellier 2001 n=65, Count=25			Debrecen 2003 n=51, Countr=22			Villa Real n=62 Countries=32		
	% of Replies	* % Count ries	%	% of Replies	* % Count ries	%	% of Replies	* % Count ries	%	% of Replies	* % Count ries	%
Inability of farmers to use ICT	29.3	40.0	3.0	8.0	9.8	9.8	21.3	18.0				
Unperceived economic or other benefits	27.6	32.0	27.6	32.0	39.2	54.5	29.5	16.4				
Too hard to use/ unfriendly	22.4	28.0	29.3	48.0	5.9	13.6	11.5	9.8				
Lack of technological infrastructure	18.9	36.0	6.0	12.0	19.6	40.9	39.3	26.2				
Cost of technology	17.6	32.0	32.3	48.0	39.2	45.5	19.6	18.0				
Unuseful information irrelevant problems	12.1	24.0	1.0	4.0	7.8	18.2	8.2	13.1				
Fear of technology	12.1	16.0	7.0	16.0	-	-	3.2	3.2				
Not enough time to spend on technology	12.1	16.0	16.9	24.0	23.5	27.2	8.2	3.2				
Do not understand the value of ICT	8.6	16.0	16.9	40.0	-	-	9.8	1.6				
Lack of training	8.6	20.0	16.9	44.0	35.3	63.6	45.9	19.6				
Better alternatives	5.2	8.0	4.0	12.0	-	-	1.6	1.6				
Personal impediments	3.4	8.0	3.0	8.0	5.9	13.6	32.7	16.4				
Poor integration with other farm systems	3.4	8.0	7.0	12.0	1.9	4.5	13.1	11.5				
Others** see above	-	-	20.0	-	31.3		16.4					

* % of countries with at least one participant from that country replying “yes”.

c. Justification of public funding

Table 3. addresses the conference indication that public funding for ICT Adoption and Services is justified and that eventually it will not only be the “farmer’s concern”. Around 85% of the replies support public funding albeit with a third of them pointing out that there should be some qualifications. Only 10% from 15% of the countries do not defend public support for ICT services. On the other hand very few replies insisted that public funding was essential. This corresponds well with the Table 2 result which showed that cost was not the most important constraint in ICT Adoption. From past evaluation this constraint varies considerably from farmer to farmer and country to country due to the multitude of financing arrangements available on the ICT market. For example the cost of ICT services can be shifted from the farmer to e.g. a produce marketing organization or a regional service. This will also save the farmer an initial capital outlay. In the context of Training “Cost” can be alleviated via public Extension services which may provide e.g. farm record management services, weather and plant protection forecasting and more. Even if the service is paid for by the farmer the cost would be less than straightforward ICT ownership.

Table 3. Is public funding for ICT services for farmers justified*?

Bonn n=58 Montpellier n=65 Debrecen =51 Villa Real = 62	% of Bonn Replies	% of Montpellier Replies	% of Debrecen Replies	% of Debrecen Countries	% Villa Real Replies	% Villa Real Countries
Support is essential	12.1	3.1	3.9	9.0	3.2	6.2
Support is justified	17.2	26.2	56.8	77.3	53.2	65.6
Support is justified with qualifications	50.0	38.5	23.5	40.9	32.2	43.7
Support should not be provided	20.7	21.5	15.7	22.7	9.7	15.6
No comment	-	10.7			1.6	3.1

*Due to the possibility of more than one reply per country these results should be read as follows – In Villa Real 3.2% of the replies from 6.2% of the countries thought that public funding is essential; 53.2% of the replies with at least one reply from 65.6% of the countries answered that public support of funding of ICT services is justified, etc.

Summary

The EFITA/WCCA conference and EFITA questionnaire data sets clearly suggest that ICT Adoption for agriculture continues to remain a major problem justifying investment of public funds to alleviate this situation. This conclusion is augmented by recognition of the fact that successful ICT Adoption is an issue of public interest involving environmental issues and rural economic viability. Lack of effective “Training” was recognized as a major ICT Adoption constraint. To facilitate Adoption and relieve individual impediments public support for Training (Extension) is an effective measure which satisfies this public concern. Cost no longer seems to be such a formidable ICT adoption constraint. ICT spillovers are yet to become a prominent factor for ICT adoption in agriculture and rural areas. Tailoring and integrating ICT for “agricultural” purposes can probably remove additional drawbacks in the available hardware and software.

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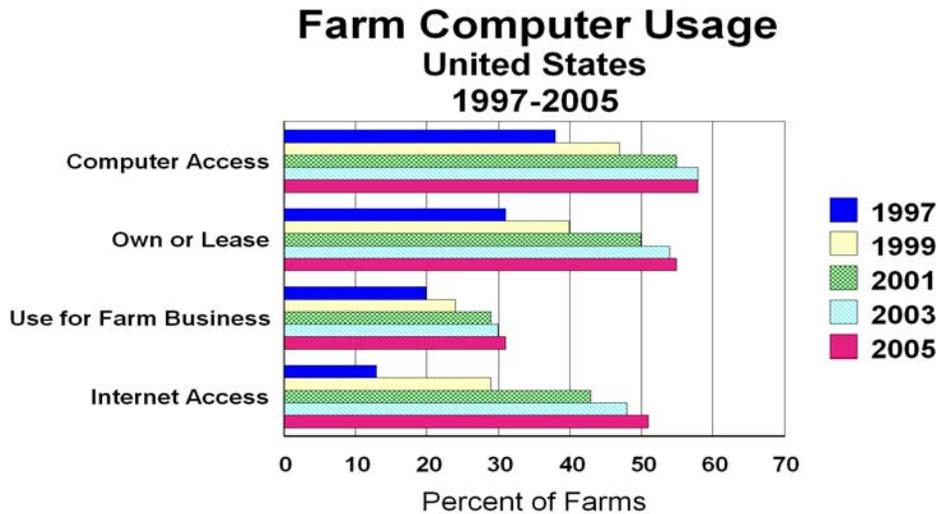


Fig.1 Source: NASS Computer Use and Ownership Survey (2005)

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