

Abstract

Farmers are expanding their use of the Internet, including e-commerce. Larger, younger, and better educated farmers are leading the charge. This article identifies factors that influence how likely particular markets are to form on the Internet and identifies example Internet sites already used by farmers for e-commerce.

Shopping at the Farm Office: What is the Future of Farm e-Commerce?

By Marvin T. Batte

The past decade has witnessed significant changes in the way farmers interact with their input providers, advisors and information providers, and product markets. A key element driving this change has been the rapid development of the Internet. An especially exciting development has been Internet-based electronic commerce (e-commerce).

Batte (2004) reported on the adoption and use of computers by Ohio commercial farmers; more than 44 percent of Ohio commercial farmers were using a computer for business management, and adoption was strongly positively correlated with farm size and operator education level, and negatively related to operator age. Perhaps more germane, the tasks for which the computer was used had changed substantially in recent years. Many farmers were using the Internet for online transactions, including financial transactions (online banking, trading of commodity contracts, stocks or bonds), purchasing inputs, and marketing outputs. In fact, and when all Internet tasks are combined, such uses are identified as one of the three most important computer tasks by 73.5 percent of computer adopting farmers. (Batte 2004, Pg. 111). The purpose of this article is to further explore farmers' use of the Internet, to suggest future changes, and to explore implications for the farm sector.

Marvin T. Batte holds the Fred N. VanBuren Professorship of Farm Management, Department of Agricultural, Environmental and Development Economics, at The Ohio State University. He received the B.S. degree from Eastern Kentucky University, M.S. from the University of Kentucky, and Ph.D. from the University of Illinois. His research and teaching address farm management, finance, and technology adoption.

Current Usage

Gloy and Akridge conclude that "firms wishing to communicate and transact business with producers via the Internet must realize that their audience is different from ordinary farm PC users" (p. 336). Previous research has documented that computer adoption tends to be directly related to farm size, operator education level, and negatively related to farmer age (Putler and Zilberman and Batte, et al; among others). In addition, farmers who worked year-around away from the farm were more likely to adopt the computer, farmers with higher reliance on leased farmland were more likely to have adopted a computer, and farmers with livestock were less likely to have adopted a computer (Batte 2005). Still, questions remain regarding how internet use and e-commerce relate to farm and farmer characteristics and what levels of adoption can be expected?

In the 2003 survey of Ohio Commercial farmer, those farmers who had adopted a computer were asked to identify which Internet applications they used on the farm. More than 84 percent of the computer adopting farmers reported some use of the Internet (Table 1). Virtually all of these individuals reported information-gathering activities ranging from e-mail, to Google-style searches, to tracking of commodity prices. About half of the computer-adopting farmers reportedly used the computer for some form of financial transaction, ranging from online banking to trading of stocks, bonds, or commodities. Banking and purchasing of inputs were the two most frequently cited online transactions, each reported by more than one-quarter of computer adopters (Batte, 2004).

Also reported in Table 1 are the Internet usage numbers for farms categorized by gross farm sales and operator education level. Even though farm size (sales) was an important determinant of computer adoption, it does not seem to be a significant determinant of adoption of online transactions. If the manager of a smaller farm was innovative enough to adopt a computer in farm business management, they were just as likely to use online transactions as their larger farm counterparts. However, the story is a bit different for operator education level. More highly educated farmers were more likely both to adopt a computer and to make use of the Internet, including for online transactions.

A binomial probit model was formulated to consider in a multivariate framework those farm and farmer characteristics that influence farmers' decisions to adopt online transactions. Results are presented in Table 2. The same explanatory variables were included in this model as were employed in the earlier analysis of computer adoption (Batte, 2005). Results confirm the results of the simple t-tests of Table 1: farm size (sales) was not a significant explanatory variable, but operator education level was positively related to the likelihood of e-commerce adoption. Farmers with a post high school education were 13.98 percentage points more likely to use online transactions than those with high school or less education levels. Operator age was statistically significant but negatively associated with adoption of online transactions. With all else equal, a one year increase in operator age is estimated to have a 0.76 percentage point reduction in the likelihood of online transactions. The percent of sales arising from livestock, percent of land that is leased, and off-farm employment, even though significant in the computer adoption model, were not significant determinants of online transactions. This supports the Gloy and Akridge supposition - that e-commerce adopters are different from computer adopters. However, these results suggest that the primary differences are personal characteristics (human capital) rather than farm business characteristics.

Internet-based market transactions – current and future

Many farm managers already use the Internet for a variety of types of e-commerce. Bejjani estimated the near-term business-to-business (B2B) market size in agricultural inputs as follows: seed (\$6-7 B), feed (\$25 B), chemicals (\$9-10 B), fertilizer (\$11 B), vet supplies (\$6 B), and equipment (\$15 B). He goes on to suggest that Agriculture will be receptive to e-commerce because the market is fragmented; the supply chain is inefficient; buyers change sellers regularly; and the value of the product can be volatile. Wheatley, Buhr and DiPietre suggest that the B2B market facing farm firms functions more like business-to-consumer (B2C) markets in other sectors because farm agribusinesses tend to be more passive, to have less market power, and tend to act as price takers. Leroux, Wortman and Mathias correctly observe that the complexity of the transaction will impact the likelihood of a successful Internet market. Specifically, buy/sell transactions must be performed such that "buyers and sellers have adequately represented the product they have for sale" (p. 209). This implies that

standardized commodities are most suited for Internet-based markets. This would include such farm input items as agricultural chemicals, crop seed, veterinary supplies, and similar items, especially for brand-name products sold in their original packaging. New farm equipment certainly fits this category, and to a lesser extent used farm machinery. In the case of used equipment, characteristics such as age and horsepower rating are standardized for the model and are easily documented, but characteristics such as condition or quality are uncertain.

To be successful, the online marketplace must reliably provide several services, including a database service to organize and store transaction data, an effective price discovery mechanism, and security (both for the data and the transaction rules) so that participants will trust the market (Wheatley, Burhr, and DiPietre). On this last point, McFarlane, Chembezi, and Befecadu found that "41 percent of the firms that have adopted the Internet perceive the issue of privacy as a barrier to adoption of e-commerce." (p. 12).

Following are a few examples of existing Internet markets with a brief description of the marketing methods employed.

Input Purchase and Financing

www.agchemical.com: This is a provider of crop protection chemicals. The site began operation in the summer of 1999 with a real-time live auction. Subsequently an instant-bid system was created which has evolved into a real-time shopping cart chemical marketplace.

www.xsag.com: XSag.com provides a secure Web site to buy and sell agricultural chemicals and other ag inputs, all in the original manufacturers' containers. XSag.com is not the seller of the products and never takes possession of products, but rather serves only as a facilitator of the transactions agreed to in the trading process. The buyer and seller are responsible for all federal and state regulatory, licensing and tax issues involved in each transaction. The site provides three ways to buy: Name Your Price (a reverse auction), Fixed Price (seller makes offer with set price), and a traditional auction.

www.findplants.com: A database driven site that enables horticultural professionals (wholesale buyers) to easily source live plants. There are 128 participating growers. Plants are priced by type and size. This is not an auction, but because prices are easily available for all growers, product price

differences are expected to be modest and to reflect only differences in location or successful differentiation by the grower.

www.icorn.com: This is the Internet location of a seed corn company that sells only on the Web. The site provides both a mechanism to purchase online and a range of information services and support to add value for the buyer.

www.buyag.com: This exchange brings buyers and sellers of tractor, combine, and other machinery parts together to help each other find and sell parts quickly, easily, and cost effectively. There are currently over 100 parts dealers registered to sell through this site. Retailers pay a commission on parts sold via BuyAg.com.

eBay Stores: The discussion of e-commerce can not be complete without some discussion of eBay and its potential to serve agriculture. Most of us are well aware of eBay, but tend to think of it as a giant garage sale rather than as a place for serious commerce by main street businesses. However, the infrastructure that eBay has developed can be used for any type of commerce and they are aggressively marketing their services to an ever-expanding clientele. The eBay store is one of their more recent innovations. With service fees starting as low as \$15.95/month, an eBay Store may be a cost-effective way for a small firm to build an online business presence.

Hamby Dairy Supply: This eBay store is a family owned/operated business that designs, sells, installs and maintains dairy equipment for cow, goat, and sheep dairy farms. They offer equipment, parts, and supplies for the largest commercial dairies, family-sized dairies, or the smallest backyard / homestead dairy.

Eagle Tractor Parts: This eBay store is the online home for Eagle Tractor Parts, established in 1986. They claim to have one of the largest computerized inventories of used tractor parts in the nation.

Capital Assets

McFarland, et al., suggest that firms selling machinery and capital items are less likely to adopt the Internet and use e-commerce strategies than are those selling feed and crop inputs, and services because "most people buying high-priced items would probably like to be able to examine, see, and feel what they are buying" (p. 12). Security, guarantees, and insurance may be necessary for online sales of large ticket items and used equipment to thrive.

LandAndFarm.com: The "global marketplace for rural property" was established in 2004 through the merger of LandAndFarm.com and Rural Property Bulletin, a quarter-century print leader in rural property advertising. This represents an online catalog of offers to sell rural real estate.

www.machinefinder.com: John Deere's MachineFinder is a Web site for searching the worldwide used equipment inventories (all makes, models, and manufacturers) of John Deere dealers.

www.ebaybusiness.com: A recent innovation at eBay is its new marketplace for capital equipment - eBay Business. In 2004, U.S. sales on eBay of capital equipment items including heavy construction equipment, agricultural tractors, metalworking lathes, forklifts, and the like grew by more than 88 percent. One of the categories available is Tractors and Farm Machinery. A perusal of the site suggests that it serves both private sales (essentially a salvage market for farmers) and as an additional sales outlet for dealers. The listing fees for capital items on eBay Business are one percent of the sale value (maximum of \$250) plus a \$20 insertion fee.

eBay may become the 500-pound gorilla in this market place. It already has significant volume. It does not require any significant investment by the firm to develop a Web presence, so small firms and individual farms are not at an economic disadvantage. The eBay equipment market is national in scope but provides search mechanisms to narrow the search. It also provides quotations from third-party shippers through Freightquote.com. To help alleviate fears of fraud or misrepresentations by sellers, eBay Business offers a Business Equipment Purchase Protection program at no cost to buyer or seller. Capital equipment purchases are protected for up to \$20,000 or the equipment purchase price, whichever is lower.

Table 3 shows an inventory of tractors that were listed for auction on eBay Business on three dates in late August and early September, 2005. Most of the equipment sold is used, although there is an increasing presence of new equipment dealers, primarily imported tractors which may not have a large, established dealer network. Tractors of all sizes and types are sold. Table 4 gives summary statistics for selected eBay auctions that ended between July 30 and August 12, 2005. Lawn and garden tractors and special purpose tractors (restored antiques, tractor pull tractors, etc.) were excluded as were tractors bundled with other equipment. Of the 134 auctions

summarized, 30.6 percent resulted in a sale. Completed sales averaged nearly 20 bids and fetched an average \$7,699 per item. Many of the sellers are dealers who frequent this market. The average seller had made 144 previous eBay sales. The average number of page views (2,758) suggests a significant number of individuals are perusing this marketplace.

Products

Online markets for agricultural products have the potential to be even more important to farmers than those for production inputs. There are two broad categories of e-commerce related to product markets: 1.) markets or tools to facilitate transactions involving agricultural commodities and 2.) online markets for differentiated products. Because commodity prices are determined in many markets worldwide, the Internet applications in the former category are probably more to facilitate communication and scheduling than anything else and thus will not likely result in revolutionary changes. However, for differentiated products, the potential for B2C markets offers great potential. A Web site allows a way to advertise the product, a mechanism for consumers to find the farm-supplier of a desired product using the search capabilities of the Internet, and opens the door to various e-commerce tools to extend the sales reach of the firm. A few example sites follow:

www.e-cooperatives.com: E-cooperatives.com is an innovative portal to directly locate and buy quality products and services online from U.S. agricultural producers and co-ops. The site is sponsored by the National Farmers Union.

www.grassfieldscheese.com: An example of a family farm differentiating their product (cheese) on the basis of production by family farmers using raw milk (not pasteurized) produced by cows spending 99 percent of their lives outside. The business sells through several brick and mortar farm stores, but also has an online catalog and electronic sales.

www.hayexchange.com: This is an example of an exchange for a commodity (hay). It provides an efficient mechanism for listings both by sellers and buyers. The two meet through search and electronic communication.

Future Use and Implications for the Farm Sector

E-commerce offers an exciting opportunity for farmers to reduce transaction costs for input purchases and may expand opportunities for firms to sell differentiated products directly to the consumer. Currently, the number of farmers using these

types of markets is small but growing. Anecdotal evidence suggests that farmers are torn between the potential to realize economic gains through use of this market and their feelings of obligation to support local businesses. The flip side is that small, local merchants may be beginning to realize the benefits of an online market presence to enable them to provide value to their farm clientele and to help retain their market share. For instance, in an analysis of the impact of online banking on community bank performance, Kagan, et al show that community banks that provide extensive online banking services tend to perform better than those who lag behind. "Results show that online banking helps community banks improve their earning ability as measured by return on equity" (Kagan, et al., p. 12). Widespread adoption of e-commerce by small merchants probably can happen only if service firms develop to efficiently provide the online infrastructure needed to support these small businesses. eBay is one existing model, but others likely will develop. We may be nearing a tipping point, where there is an avalanche both of farmers and farm merchants using the market and small firms offering support services.

Some authors have pointed to a lack of high speed Internet access as a key limitation of e-commerce in rural areas, however this restraint may be disappearing. The Federal Communication Commission estimates that as of December 31, 2004, 95 percent of zip codes nationally have access to one or more high speed internet service providers. In Ohio, 99 percent of ZIP codes have high speed Internet service. Effectively, this constraint may be behind us.

References

- Batte, Marvin T. "Computer Adoption and Use by Ohio Farmers." *Journal of the American Society of Farm Managers and Rural Appraisers*, 2004:108-111.
- Batte, Marvin T. "Changing Computer Use in Agriculture: Evidence from Ohio". *Computers and Electronics in Agriculture* Vol 47 (2005): 1-13.
- Batte, Marvin T., Eugene Jones, and Gary D. Schnitkey. "Computer Use by Ohio Commercial Farmers". *American Journal of Agricultural Economics*. Vol. 72 (1990):935-945.
- Bejjani, Ghassan. "Venture Capital Perspectives on the Ag.com Industry." February 28, 2000. Presentation at CARD 2000 Agricultural Forum "e-commerce: The Net Effect on Agribusiness." Accessed on May 1 2001 at <http://www.agforum.org/2000/home.html>
- Federal Communications Commission. "Federal Communications Commission Releases Data on High-Speed Services for Internet Access" *FCC News* July 7, 2005. Available on the Internet at <http://www.fcc.gov/wcb/iatd/comp.html>.
- Gloy, Brent A., Jay T. Akridge. "Computer and Internet Adoption on Large U.S. Farms". *International Food and Agribusiness Management Review* 3 (2000): 323-338
- Kagan, Albert, Ram N. Acharya, L. S. Rao, and Vinod Kodepaka. "Does Internet Banking Affect the Performance of Community Banks?" Selected Paper presented at the American Agricultural Economics Association Annual Meeting, Providence, Rhode Island, July 24-27, 2005.
- Lemoux, Nicole, Max S. Wortman Jr., and Eric D, Mathias. "Dominant Factors Impacting the Development of Business-to-Business (B2B) E-Commerce in Agriculture." *International Food and Agribusiness Management Review* 4 (2001):205-218.
- McFarlane, Dionne, Duncan Chembezi, and Joseph Befecadu. "Internet Adoption and Use of E-commerce Strategies by Agribusiness Firms in Alabama". Selected paper presented at the Southern Agricultural Economics Association Annual Meeting, Mobile, Alabama, February 1-5, 2003
- Putler, Daniel S., and David Zilberman. "Computer Use in Agriculture: Evidence from Tulare County, California." *American Journal of Agricultural Economics* 70(1988):790-802.
- Wheatley, W. Parker, Brian Buhr, and Dennis DiPietre. "E-Commerce in Agriculture: Development, Strategy and Market Implications". Staff Paper P01-6, Department of Applied Economics, The University of Minnesota, July 2001.

Table 1. Internet Use for Information Gathering and Online Transactions by Farm Size and Operator Education Level

Full Sample	Adoption Percent	
Information Gathering ^a	84.0	
Transactions ^b	50.3	
All Internet Uses	84.5	
Gross Farm Sales	\$40,000 - 249,999	\$250,000 and Over
Information Gathering	82.1	87.6
Transactions	47.9	54.8
All Internet Uses	82.1	89.7
		*
Operator Education Level	High School or less	Post High School
Information Gathering	76.8	89.4
Transactions	42.5	56.6
All Internet Uses	78.2	89.4

* One, two and three asterisks indicate a difference of means that is statistically different from zero at the 0.10, 0.05, and 0.01 probability levels, respectively.

^a Information gathering activities include e-mail, commodity price tracking on the Internet, and Google-style searches of the Internet.

^b Transactions identified include online banking or bill paying, buying inputs or selling products over the Internet, and online trading of commodity contracts or stock and bonds.

Table 2. A Binomial Probit Model of the Use of the Internet for Transactions by Computer-adopting Farmers.^a

Variable	Coefficient	Standard Error	Marginal Effects
Constant	1.0754	0.5392	**
Sales (\$1,000)	-0.0003	0.0003	-0.0001
Age	-0.0191	0.0083	**
Operator Education ^b	0.3524	0.1509	**
Livestock%	-0.0006	0.0023	-0.0002
Tenancy%	-0.0014	0.0024	-0.0006
Seasonal employment ^c	-0.2373	0.2647	-0.0941
Fulltime employment ^d	-0.2500	0.1768	-0.0995
Log-likelihood function		-201.94	
Restricted log-likelihood function		-207.94	
Chi Square		11.99	*
Frequency of actual and predicted values ^a			
	Predicted		
Actual	0	1	Total
	0	84	65
	1	60	91
Total	144	156	149

^a The dichotomous dependent variable is 1 for producers who use the Internet for Transactions and is zero otherwise.

^b Education takes on the value of one if the operator has a post-high school education level and is zero otherwise.

^c Seasonal takes on the value of one if the operator is employed seasonally away from the farm and is zero otherwise.

^d Fulltime takes on the value of one if the operator is employed year-around away from the farm and is zero otherwise.

* One and two asterisks indicate coefficients that are different than zero at the 0.10 and 0.05 probabilities levels, respectively.

Table 3. Count of Tractors Offered for Sale on e-Bay Business at Three Points in Time

	Inventory Date		
	8/27/2005	9/3/2005	9/10/2005
Total	358	336	345
New	26	39	36
Used	332	297	309
Drive Axels			
2wd	178	158	159
4wd	157	158	167
Manufacturer			
CaselH	27	27	37
Ford	38	47	37
JD	82	63	78
Kubota	52	50	46
MF	26	19	11
NH	19	16	16
Yanmar	13	6	5
Other	103	112	112
Horsepower			
hp<25	108	91	98
hp25-35	84	71	70
hp36-55	39	58	47
hp56-100	46	40	43
hp>100	19	16	21
Fuel type			
Diesel	286	266	271
Gas	66	64	68

Table 4. e-Bay Tractor Sales for Auctions Ending Between July 30 and August 12, 2005

Number of Auctions ^a	134
Percentage of auctions resulting in sale	30.6
Average Number of Bids for successful sales	19.5
Average Price	7,699
Average number of previous sales by seller	144
Average number of page views for successful sales	2,758
Percent of sales that are new tractors	7.3

^a Excludes lawn tractors and tractors bundled with equipment. Also, excludes specialty tractors such as restored antiques and tractor-pulling tractors.