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Emergent E-Commerce in Agriculture

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E-commerce redefines the rules of doing business, its future is spectacular, those who embrace it early will be the winners but the hesitant will be obliterated. This is what New Economy pundits kept telling us while share prices of dot.coms soared. When stock prices dropped sharply in April, 2000, some of the fun was over but that did not spell the end of e-commerce.

E-commerce has penetrated agriculture in California as well as the rest of the world. By 2000, one in 25 U.S. farms had already bought or sold agricultural products on the Internet (USDA, Agricultural Resource Management Study, 1999). Goldman Sachs estimates that 12% of all agricultural sales in the U.S. will be conducted over the Internet in 2004, compared to only 4% in 1999.

The advent of e-commerce in agriculture raises many questions: What e-commerce business models are best suited for which agricultural markets? What is the impact of e-commerce on farms, agribusiness firms, markets, and rural communities? Are there only winners or are there losers too? If so, who are they? What will government do to, with or against e-commerce in agriculture? And, what should leaders in agriculture do to ready themselves and the industry for e-commerce?

Since e-commerce is still evolving, it is too early for definitive answers. An inspection of current practices, however, suggests that distinct patterns are emerging in agricultural e-commerce and what we see already may help foretell future developments and impacts of this new way of doing business. This Issues Brief provides some background, some current facts and some interpretation of the role of e-commerce in agriculture.

The concept

Whether agricultural or not, we define e-commerce simply as business transactions conducted over the Internet. This definition allows for many different ways of conducting business. Transactions may involve material goods, immaterial services, or rights and obligations. Payment may be online or off the Internet. Access to Internet communication channels used in e-commerce is often open to everyone but is sometimes restricted, and the messages exchanged may be rigidly standardized, as in Electronic Data Interchange (EDI).

E-commerce transactions are often classified according to the partners involved – consumers, business, and government. With three types of partners, six combinations are possible but only two are presently important: business-to-consumer (B2C) and business-to-business (B2B). Of the two, B2C e-commerce currently receives most public attention. This is hardly justified by its present volume, which accounted for a miniscule 0.64 percent

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of total retail sales, including agriculture, in the last quarter of 1999 (U.S. Department of Commerce, 2000). Volume of B2B e-commerce, in contrast, is considered to be much larger. According to Forrester Research more than three out of four large companies will be trading online by 2002 and the Boston Consulting Group expects about 25 percent of all commerce among businesses in the US to be conducted over the Internet by 2003.

Government is also joining e-commerce. Government-to-Citizen (G2C) as well as Government-to-Business (G2B) applications will soon be available at the government web site www.firstgov.gov. According to that site, by the end of 2000 the U.S. government will allow business to apply via Internet for some of the $300 billion of grants and it will let suppliers bid on some of the $200 billion in government contracts for goods and services.

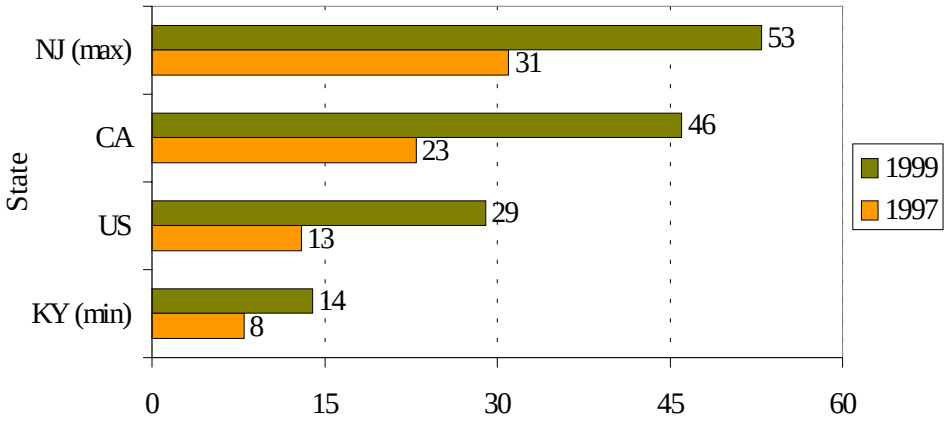
E-commerce readiness of agriculture

Participation in e-commerce requires that both buyers and sellers have access to the Internet, and that they are able to use the required hardware and software effectively. Furthermore, the part of e-commerce that is observable to third parties is conducted on the World Wide Web of the Internet, where at least one party to a transaction must operate a web site. Most often the web site is run by the more specialized party in a particular type of transaction, such as the sellers of farm inputs or the buyers of farm outputs. The less specialized party, such as the farmer, need only have access to the Internet in order to participate in e-commerce on the web.

It is impossible to get a complete and current sense of what is available on the web. For example, a search through the "agriculture" and "food and beverages" sections of the California Yahoo Internet "Yellow Pages" yielded over 500 functioning links to California agricultural sites. About half of these links were to wineries, and another 60 were to small farms, with many offering B2C e-commerce. B2B e-commerce was also a significant presence, with California-based companies advertising and offering a variety of pre- and post-harvest products and services for farmers. However, even though the Yahoo search yielded a large number of links to a variety of sites, it was certainly not an exhaustive list of California agriculture and agribusiness firms. It yielded links to some of California's major agricultural companies and cooperatives such as Calcot and Blue Diamond, but surprisingly left out others such as Sunkist and Morning Star. Furthermore, even if a complete listing were available today, it would be out of date tomorrow.

Data published by the National Agricultural Statistics Service show that 29 percent of U.S. farms had Internet access in 1999 (Fig. 1). Internet penetration in the agricultural sector of most states is below the U.S.

Figure 1: Percent of Farms with Internet Access, US and Selected States, 1997 and 1999



total and a rural-urban divide exists (Bikson and Panis, 1999). California ranks high among the states in computer and Internet use: It ranks sixth in computer ownership among farms (55%), second in the share of farms that use computers for farm business (40%), and third in the share of farms with Internet access (46%). These percentages have increased considerably in recent years. As shown in Figure 1, the share of California farms with Internet access doubled between 1997 and 1999.

Statistical evidence on farmers' use of the Internet is rare. One study by Rockwell Research/FJIR (www.fjir.com) of Internet use by some 400 commercial farmers found that farmers primarily use the "Net" to access information on commodity prices, weather, farm chemicals, and machinery. The study also found that farmers are quick to make the switch to e-transactions, specifically with regard to purchasing seed, crop chemicals, and machinery (NUA, 2000).

E-commerce applications in agriculture

The web allows many uses that can be combined in many ways. For example, displays may be static or animated, search for specific products may be assisted by a search function, sound may be added, payment by credit card may be possible, encryption may enhance the security of transactions, etc. The result is an evolving, diverse set of e-commerce uses and business models. Amid the diversity and change, patterns of e-commerce practices in agriculture are emerging. What provides order to the diversity is not so much technological capabilities and constraints as it is economic interests and necessities that are as valid on the Internet as in other markets. We therefore group agricultural e-commerce sites into four categories according to the economic purpose they apparently serve:

- Saving transaction cost
- E-market intermediation
- Integrating e-commerce services
- Providing e-commerce support services

Most sites serve several purposes and the examples are only indicative. There may be other agricultural e-commerce sites that better represent the group.

Saving transaction costs

A transaction comprises flows of information, of merchandise, and of money. In conventional transactions different media are involved in the three flows. For example, there are physical displays signaling the availability of products, vision and touch for their inspection, print to communicate the terms of exchange, and paper and metal as means of payment. In e-commerce, however, all information, money, and sometimes even the merchandise too, are transformed into binary digits or bits, which can be sent through the Internet over long distances at the speed of light and at zero marginal cost.

The Internet may reduce transaction costs by lowering trading costs, or transfer costs, or both. Trading costs fall when search by buyers and sellers is facilitated, when the costs of adjusting posted prices are lowered, when negotiations between geographically separate buyers and sellers are facilitated, and when fulfillment can be monitored more easily. When transactions involve goods that can be digitized, such as money, information products, or rights and obligations, transfer costs are saved on top of trading costs. Furthermore, because communication costs on the Internet are largely independent of data volume and distance between sender and receiver, geographic distance is unimportant in search and negotiation. Finally, the Internet has the most profound impact on trading costs when information is digitized, e.g. when cattle or fresh produce are sold by digital video rather than by physical display.

Cost savings from e-commerce can be substantial. For example, transaction costs in the banking industry are reduced from $1.30 for a counter transaction to $0.27 for an online transaction (NUA, 2000), and the Ford Motor Company expects to reduce its purchasing costs from $100 to $10 per transaction by using its newly developed purchasing platform (Wirtschaftswoche, 2000). Cost savings from e-commerce in agriculture have not yet been reported, but there is no reason to expect them to be smaller in agriculture than in other industries. Sometimes savings in purchasing costs from e-commerce are accompanied by price discounts.

Since physical services and products cannot be delivered through the Internet, only part of the transactions costs are saved. Digitized information products, in contrast, are prime candidates for e-commerce. Several agricultural information providers offer and deliver their products online. Often the information includes weather forecasts, news, and market intelligence, sometimes customizable by the buyer (www.agriculture.com; www.agweb.com, www.theagzone.com). Some supply current market prices for a range of farm products (www.todaymarket.com), others offer forecasts and data on crops and livestock (www.wefa.com). Some sites make clever use of the web by, instead of directly delivering information, providing hyperlinks that lead users to sites with business and market information (www.internetstats.com).

Agricultural management and consulting services are also available on the Internet. For example, some sites provide management support tools such as analysis of soil data, database management for farm and site-specific data, farm and field maps, crop models, cropping recommendations, and storage and sales tracking systems (www.mpower3.com; www.vantagepoint.com). Similar smart sites are also available for livestock producers who, among other things, are helped to detect illnesses in a herd (www.emergeinteractive.com).

It is not clear whether there are any products, services, or rights that cannot be traded more conveniently by using the Internet for part or all of the transaction. A large and seemingly swelling number of agribusiness firms offer their wares with online sales facilities or by showing a catalog of their products. Even some Old Economy catalog firms have moved to the web (www.sloanex.com). Business services for agriculture are also offered on the web, such as online banking and finance (www.farmcredit.com), property insurance (www.ag1.com), farm management services (www.ag1.com), and buyer representation at farm sales (www.buyafarm.com).

E-commerce intermediaries

When the costs of using the market fall, as is the case in e-commerce, some activities previously carried out within a firm will be coordinated through the markets (Coase, 1998). This is true for production activities as well as for information and trading activities. Therefore, reductions in transaction costs will not eliminate market intermediaries, as some pundits of a "friction-free e-economy" predict. Rather, reduced transaction costs encourage new and different market intermediation activities. The New Economy apostle Kevin Kelly stated this as: "Networks are the cradle of intermediaries."

There are four categories of intermediaries:

- Providers of classified ads and directory services
- Match makers
- Market place providers
- Auctioneers

Providers of classified ads and directory services

The web is vast and finding what is needed can be a chore. The search can be made easier by providers of classifieds and directory services that often specialize in product categories, such as livestock (www.agriads.com), live plant material (www.findplants.com), farm labor (www.usda.gov; www.agnet.com), ground- and surface water (www.waterrightsmarket.com), or combinations of categories (www.agrimall.com; www.powerfarm.com;

www.growit.com). Sometimes the combinations are surprising; a directory for used farm equipment and machinery also provides a search-and-find service for singles (www.fastfinder.com).

Match makers

Match makers attempt to connect buyers and sellers of specific products and services. Such services are much more information-intensive than directories and they exploit the Internet's capacity for interactivity. For example, buyers of new and used agricultural equipment may submit a price quote request to www.buyag.com. The request is then passed on to participating retailers who, in turn, submit quotes. Buyers then submit shipping and credit card information and the seller chosen by the buyer is informed about the transaction. Similarly, www.rooster.com, a site set up by a consortium of large agribusiness firms, will connect buyers of farm inputs and sellers of outputs with local dealers.

Market place providers

Electronic markets allow buyers and sellers to exchange information about product offerings and prices bid and asked. Many also post the prices of successfully concluded negotiations. Electronic marketplaces in U.S. agriculture date back about a quarter century. For example, cotton has been traded electronically by TELCOT since 1976 (Lindsey et al., 1990), and an early boom in electronic marketing of agricultural products occurred in the late 70s and early 80s (Henderson, 1984). However, those systems did not use the Internet and they were inaccessible to most market participants.

Once the Internet opened to commercial applications it was only a matter of time until entrepreneurs began to compete by offering various designs of agricultural e-commerce market places for a host of agricultural inputs and outputs. Some e-markets focus on crops for which California is the sole or dominant U.S. producer, including wine, almonds, walnuts, raisins, prunes and processed tomatoes (www.wineryexchange.com, www.agex.com). E-markets have also been installed for meat and poultry (www.SellMeat.com), corn, wheat, soybeans, rice, and other grains (www.cybercrop.com, www.e-markets.com), for perishable agricultural produce (www.TradingProduce.com), and for farm chemicals and other farm inputs (www.directag.com, www.agriplace.com). Some allow trades of inputs and outputs as well (www.folnetworks.com). Whereas many e-marketplaces are intended for agribusiness, farmers and ranchers, some are targeted at retailers of farm produce (www.agribuys.com), and others at wholesalers only (www.TradingProduce.com). Of particular interest to farmers in California is www.horsepower.com, a marketplace for farmers and agribusiness where more than 400 agricultural commodities can be traded and to which members of the California Farm Bureau Federation have free access.

A widely held misperception suggests that the openness of the Internet must somehow result in e-markets that are more open and transparent than conventional markets. This need not be so. Information available on the Internet can be private, and personalized information is often a desirable feature of the Internet. Some markets exploit this option and allow either public or private price negotiations and bidding (www.SellMeat.com; www.TradingProduce.com), others allow only private price negotiations (www.agribuys.com). Obviously, markets with private negotiations and undisclosed prices contribute nothing to the transparency of price formation and the information content of price statistics.

Auctioneers

Auctions are market places where prices are negotiated publicly according to certain rules. E-auctions have sprung up on the web for many agricultural inputs and outputs. There are auctions for livestock (www.onlinelivestockauction.com), grains and feed (www.icecorp.com), hay (www.hayexchange.com), farm supplies (www.farmbid.com), and equipment parts (www.XSAg.com), and probably many more agricultural items that promise a reward for the entrepreneur organizing an auction on the Internet.

Auctions are often distinguished by their bidding rules. In English auctions, buyers bid for the item offered until only one buyer remains. In Dutch auctions, in contrast, the ask price is reduced until the most eager buyer accepts; in double auctions, buyers increase their bids and sellers reduce their prices asked until a match occurs. A variant popular on e-auctions is the demand bid in which buyers post a bid at which they are willing to buy an item. There is no clear trend in the choice of bidding rules used in e-auctions. At some auctions prices are determined by only one auctioning rule (www.icecorp.com), at others several rules are used (www.XSAg.com).

E-commerce integrated services

Several web sites present themselves as agricultural "portals" and attempt to provide a range of information services as well as market intermediation (www.farms.com). However, because visitors can easily move from one web site to the other when they are connected by hyperlinks, it is possible for a group of highly specialized web sites to form hyperlinked web communities. A recently created site, vTraction (www.vTraction.com), is a portal that then leads its visitors to several specialized e-commerce market places.

Since most agricultural products cannot be digitized, integration with warehousing, transport, inspection and insurance services may be necessary if the full advantages of e-commerce are to be realized. Such services are offered either as specialized services (www.ifulfill.com, www.dhl-usa.com) or, more often, by market intermediaries (www.foodtrader.com).

E-commerce support services

Participation in e-commerce requires that a firm be present on the web with its own site. For farmers and small businesses it often does not pay to have a sophisticated site and a modest home page may do. These users are served by Internet service providers focused on agriculture, who bundle Internet services with information and market intermediation (www.agdomain.com). For more demanding farmers and agribusinesses there are also programming houses that provide web sites for the agricultural industry (www.Agribiz.net, www.tazworks.com).

What next?

Skimming the web for evidence of emerging patterns in agricultural e-commerce misses activities that are carried out in the privacy of extranets—networks that use Internet technology to link businesses directly to their suppliers, customers, or other businesses. In agriculture, where many farmers use less powerful technologies for accessing the Internet, this invisible part of e-commerce is arguably less important than in other industries. Nevertheless, more information is needed on this hidden section of agricultural e-commerce.

In any case, the visible part alone provides ample evidence that e-commerce in agriculture is here to stay. Rather than disappear from agriculture, e-commerce will evolve—probably in unpredictable ways. The reason for the uncertainty is not the technology on which e-commerce is based. That technology and its adoption will continue to be based on three reliable growth rates:

1. Moore's law of microchip capacity growth
2. Growth of hard disk capacity
3. Gilder's law of Internet bandwidth growth

According to Intel's Gordon Moore (1997) the cost of silicon wafer used for microchips has been constant at $1 billion per acre. What changes is its yield in terms of active transistors. With every new technology generation, the size of the active components shrinks by 70% and only half the area of silicon is required for the same number of transistors. This has allowed the capacity of microchips to double every 18 months, which is the

time it takes from one microchip generation to the next. As the capacity of microchips increases, costs per computation fall. Whereas the capacity to carry out 1000 calculations per second cost about $180 in 1980, the cost had fallen to $0.0075 by 1998 (Kurzweil, 1999). This is equivalent to a 43 percent annual decline in the price of computing capacity.

Even this rate of microchip capacity growth is modest compared to growth of hard disk capacity. Since the introduction of the magnetic hard disk in 1957, the density of data stored has increased 1.3-million-fold and recently disk capacities have been doubling every nine months. Growth in data density and capacity has resulted in sharply falling prices. Whereas the average price per megabyte for hard disk drives was more than $11 in 1988 it has fallen to $0.02 in 1999 and is expected to fall further to reach $0.003 in 2002 (Toigo 2000). This is equivalent to a price drop of about 45 percent per year.

Bandwidth is the amount of bits that can be sent through a network connection per unit of time. Gilder's law (1997) states that the total bandwidth of communication systems will triple every year for the next 25 years.

However, by themselves and in combination, the three growth rates have had little impact on the emergence of e-commerce. Commerce and industry took no notice of either the introduction of the Internet in Boston in 1972, or of the birth of the World Wide Web at CERN in Switzerland in 1991. Only in 1995, when the large dial-up online providers allowed the general public to access the Internet, did it begin to spread. Since then uncounted innovative entrepreneurs have forged from Internet technologies business tools that transform unprecedented technological change into business opportunity.

E-commerce entrepreneurs have also helped to unleash powerful network effects. Communication lines and bandwidth have no value unless they connect and are used by senders and receivers. When a network attracts new users, for example because it provides attractive e-commerce applications, its value increases for all existing and potential users. This effect is also known as "Metcalfe's Law" which states that the value of a network to its users is approximately proportional to the square of the number of its users (Shapiro and Varian, 1998).

Vigorous entrepreneurship and the powerful dynamics of network effects bode ill for agricultural e-commerce practices and business models that settle into static patterns any time soon. They also foil any attempts of accurately predicting specific trends. But the inability to predict the future of e-commerce should not be mistaken as an argument that e-commerce has no future in agriculture. Rather, we should heed two related rules of forecasting. One rule was told by Paul Saffo of the Institute for the Future, "The most important rule [of forecasting] I actually learned was….to never mistake a clear view for a short distance." A corollary to Saffo's clear-view-rule is the misty-view-rule used by sailors: "Never mistake a misty view for a long distance!" Our inability to predict what e-commerce in agriculture will be like in three to five years should not be taken to mean that e-commerce will not grow vigorously and evolve in agriculture as in other industries. Chances are it will. ■

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