Market Process Reengineering through Electronic Market Systems: Opportunities and Challenges

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ABSTRACT: Over the past few years, various electronic market systems have been introduced by market-making firms to improve transaction effectiveness and efficiency within their markets. Although successful implementation of electronic marketplaces may be found in several industries, some systems have failed or their penetration pace is slower than was projected, indicating that significant barriers remain. This paper analyzes the economic forces and barriers behind the electronic market adoptions from the perspective of market process reengineering. Four cases of electronic market adoptions—two successful and two failed—are used for this analysis. Economic benefits are examined by investigating how the market process innovation enabled by information technology (IT) reduces transaction costs and increases market efficiency. Adoption barriers are identified by analyzing transaction risks and resistance resulting from the reengineering. Successful deployment of electronic market systems requires taking into account these barriers along with the economic benefits of adoption. The paper presents suggestions based on these case studies, which are relevant to the analysis, design, and implementation of electronic market systems by market-making firms.

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ELECTRONIC MARKETS HAVE BECOME INCREASINGLY POPULAR ALTERNATIVES to traditional forms of commerce as the costs of electronic communications decline and as the ability to convey complex information through networks increases. The role of market-making firms, such as commodity exchanges or livestock auctions, is to reduce the cost of carrying out transactions. These organizations have emerged to facilitate their member traders' transactions and to establish trade rules governing the rights and duties of those carrying out transactions in their facilities [11, 21]. Over the past decade, many market-making firms have adopted electronic market systems to increase transaction effectiveness and efficiency within their markets. One characteristic shared by these systems is the decoupling of the logistics (product flows) from the market transactions through on-line trading.

This paper examines market-making firms' adoptions of electronic commerce by investigating the fundamental economic and social attributes that influence market efficiency and transaction risks. Although electronic marketplaces have been adopted successfully in several industries, the translation of technical possibilities into institutional realities is often slow or ends in failure. There are clearly barriers as well as opportunities. The key questions driving this research are: What are the major economic forces driving electronic market adoptions by market-making firms? What risks or barriers behind electronic market adoptions limit successful implementation? Why do electronic markets often fail, despite economic benefits that are well documented at the time of adoption? What strategies can market-making firms employ to reduce barriers and to avoid adoption failure?

Much has been written in recent years about changes in cooperative strategies and industry structures associated with electronic hierarchies and electronic markets. Malone, Yates, and Benjamin suggested that the introduction of electronic commerce would lead to greater use of markets rather than hierarchies as IT reduced transaction costs [27]. Hess and Kemerer tested this electronic market hypothesis using a case study of computerized loan organization systems [20]. Gurbaxani and Whang integrated the transaction-cost argument with an internal agency cost to examine firm boundaries [16]. Many authors have pointed out that firms using electronic commerce often produced new forms of organization, such as networks [35] and value-adding partnerships [22], instead of simply increasing firms' reliance on markets. Clemons, Reddi, and Row argued that, when firms increased outsourcing, they do so with a limited number of long-term trading partners due to increased opportunistic and operational risks [7, 8]. Bakos and Brynjolfsson included the concept of noncontractible investments in coordination costs to explain why buying firms limited the number of suppliers [4, 5].

The study of electronic commerce for market-making firms requires a different approach from these previous works. Neither the question of the economic coordination

mechanism (hierarchies, networks, or markets) nor the question of firm boundaries (produce or outsource) is relevant. The analysis needs to begin with understanding of traditional market processes and to investigate how conventional transaction methods are changed as a result of electronic market adoption. This paper examines the evolution of electronic market systems from a reengineering perspective, which we call market process reengineering (MPR). That is, we view the introduction of the on-line trading system as a strategic move by market-making firms to innovate the transaction process within institutional markets.

The advantage of MPR is that it allows us to analyze both opportunities and barriers associated with electronic market adoptions. On the one hand, economic incentives can be examined by studying how the new transaction process, enabled by IT, improves market efficiency. On the other hand, analysis of resistance to the change can explain failed adoptions. This paper investigates four cases of electronic market adoptions from various industries: CALM for livestock trading, AUCNET for used-car trading, Information Auctioning for potted plants trading, and CATS for meat trading. All of these systems have been introduced by existing or new market-making firms to bring innovation to traditional market processes. CALM and AUCNET have been successful since the beginning of their services. The other two systems ceased operations after only one or two years. By analyzing both successful and failed cases, we examine the barriers as well as the economic forces behind the adoption of electronic market systems, and develop suggestions and strategies for market-making firms to limit the risks of failure in adopting electronic commerce applications.

Market-Making Firms and Electronic Markets

Why Organized Markets Emerge

WE CONSIDER MARKET-MAKING FIRMS AS SOCIAL INSTITUTIONS in which a large number of commodity exchanges of a specific type regularly take place, facilitated and structured by institutional rules governing the exchange. Market transactions involve contractual agreement and the exchange of property rights; market-making firms provide mechanisms to structure, organize, and legitimate these activities. An example of a market-making firm is an auction market, which involves the use of a specified method, custom, or routine for reaching agreement on a price.[1] The auction organization offers trading rules that structure the bidding process and trade settlement, in addition to publicity, clerical work, bidding place, storage space, and so on. Thus, market-making firms provide not only places for exchanges but also institutional rules to standardize and legitimate exchanges made within their facilities [21].

Transaction costs are the costs of obtaining relevant information, of bargaining and making decisions, and of policing and enforcing contracts [10]. They can be reduced if traders complete transactions in markets organized by market-making firms, rather than in fragmented, nonmarket exchange [21].[2] The costs of obtaining relevant information are reduced dramatically through creation of an organized market since

market-making firms help publicize prices as well as other relevant information. Regularized access to contacts within the market itself reduces costs by making it easier to find preferable trading counterparts. Bargaining costs can be reduced too as market-making firms help establish procedures and conventions for reaching a bargain, and traders more easily formulate their expectations about what kind of deal they may strike. Furthermore, deals are likely to be carried out more rapidly since the options for transacting with alternative buyers and sellers present in the market are clear to both parties. Policing and enforcement costs can be reduced because market-making firms bring norms of conduct and codes of practice for buyers or sellers. The individual is not alone in ensuring that the contract is carried out because market-making firms regulate all the transaction activities in great detail, such as the responsibilities of parties and the terms of settlements.

Electronic Market Systems for Market-Making Firms

We differentiate electronic market adoptions by market-making firms from consumer electronic shopping systems over the Internet. The tremendous growth of the Internet, and particularly of the World Wide Web, has dramatically increased the number of new intermediaries such as Web Shop, Internet Mall, IndustryNet, and Internet Shopping Network, which interpose themselves between producers and customers in the industry value chain to take advantage of new types of economies of scale, scope, and knowledge enabled by the Internet [31]. These intermediaries allow vendors to advertise their products to millions of prospective consumers, while allowing customers to place orders electronically [19].

These new electronic intermediaries in cyberspace, however, do not include discovering the market price of goods [25], although they have potential to influence retail prices by increasing competition among suppliers [3]. They usually employ posted-off pricing [32], where producers list ask prices and consumers decide how many items to buy at the posted price. In these systems, suppliers are price makers and on-line trading systems help determine quantities traded at relatively fixed prices. This contrasts with market-making firms' electronic market systems, one of whose major functions is to determine the market price of goods. Sellers who join the market institutions (such as farmers in livestock auction) have fixed quantities for supply without price tags: Sellers are price takers, not price makers, although they have a certain level of reserve prices. Electronic market systems play an important role in determining the market price of goods through either electronic auctions or electronic negotiations [25].

In addition, buyers who purchase goods in market institutions are not end consumers but typically wholesalers who resell their purchased items to retailers. Since the quality of offered products varies widely (even products from the same producer differ in quality time to time, as in the case of agricultural products such as livestock or cut flowers), descriptions of the product quality are essential to buyers who regularly join the institutions to purchase goods at the wholesale level. In contrast, products sold in electronic shopping systems over the Internet are mostly standardized and mass-

produced (products from one supplier are identical). These systems typically target retail consumers who purchase goods based on price tags and brand names.

Finally, traders completing transactions through market-making firms are subject to institutional rules established to reduce transaction uncertainties and to protect member traders against transaction conflicts. Agreement over the governing rules can be facilitated because the members meet frequently and deal in a restricted range of goods. It is possible to enforce the rules because the opportunity to trade on the exchange itself is of great value: withholding permission to trade is a sanction sufficiently severe to ensure compliance for most member traders. When the transaction facilities are scattered and owned by a vast number of people, as in the case of various on-line shopping systems over the Internet, the establishment and administration of a private legal system would be very difficult. Those who operate in these markets therefore have to depend on the legal system at the state level.

It is nevertheless possible for existing or new market-making firms to use the Internet to build electronic market systems. In the past, for example, the Federal Communications Commission (FCC) allocated radio spectra either by lottery or by comparative hearings.[3] In an attempt to revamp the method of allocating public resources, the FCC implemented an Auction Bidding System (ABS) to sell broadband Personal Communications Service (PCS) licenses to public bidders [40]. Through a high-tech auction designed to maximize revenues quickly, the FCC sold 99 broadband PCS licenses for 51 market regions in 1995 and raised $7.7 billion for the U.S. Treasury. Although the auction was held in Washington, DC, firms throughout the country used the on-line electronic messages to place their bids [2]. Unlike on-line shoppers for retail goods in the Internet, however, participants had to sign the agreement for trading rules that specify every detail of the bidding processes and responsibilities of bidders; anyone who violated the agreement was left out of the market.

Market Process Reengineering

Decoupling Product Flow from Market Transactions

BUSINESS PROCESS REDESIGN (BPR), ALSO KNOWN AS REENGINEERING, enables organizational transformation [13, 14, 18]. Firms embrace a BPR approach when a radical improvement can be achieved by realigning business process with information technology (IT) change. BPR requires a firm to step back from current business processes to consider its overall business objective; only then can it create radical change to realize improvements of any magnitude [17]. Information technology is usually a necessary but insufficient factor in achieving BPR. Successful reengineering is not an IT initiative but, rather, a business initiative, although IT has been described as both a strategic catalyst and an enabler of BPR [15, 34].

Market-making firms in various industries have used the BPR approach to redesign existing processes inside their firms. When goods arrive at the market for sale, a clerk enters information regarding the producer, product type, and quantity into the control

computer. Once transactions occur, either by face-to-face auction or negotiation, the computer consolidates all purchase information for settlement of accounts and generates transaction reports for buyers and sellers. Thus, IT is already being used to speed up existing transaction processes while reducing labor costs. However, the use of computers for BPR inside market-making firms does not necessarily require changing the market transaction process and associated institutional rules governing these market processes.

Market-making firms have come to understand that the market process can be redesigned using telecommunications as well as computers. In traditional transactions, suppliers had to bring their products to the marketplace and buyers wishing to purchase goods also had to be present at the market in order to inspect the goods and to participate in the bidding process. Goods sold by either auctions or negotiations were handed over to buyers who transported them back to the buyer's location. In the new approach, product flow is separated from the market transactions by connecting the central computer with terminals at member traders' locations using communication networks (see figure 1). In this new virtual marketplace, transactions are based on information and products move from sellers directly to buyers only after on-line transactions are completed.

On-line trading is not automation of traditional market processes, but market process reengineering which brings innovation to the transaction process and to the role of market makers. Suppliers offer their products in electronic forms instead of transporting them to the markets. Buyers place electronic bids in their offices rather than coming to the market. Transactions are executed based upon information seen on computer terminals, with no need for products to be present physically. Goods remain at suppliers' locations and are not shipped until the transaction is completed.

Research Framework and Methodology

Our research model presumes that market makers adopting electronic market systems would encounter barriers to realizing the expected improvements in market efficiency (see figure 2). To implement electronic market systems successfully, adoption barriers must be identified and properly managed, along with implementing systems to improve transaction efficiency and effectiveness. The success of the adoption depends on creating and sustaining the identified economic gains while reducing potential barriers. This paper identifies economic gains and barriers resulting from electronic market adoptions and examines how firms can manage risks and barriers in the course of market process reengineering.

Increased Transaction Effectiveness and Efficiency

Every market transaction consists of *information gathering, contract formation*, and *trade settlement* [25]. Information gathering reflects the process by which traders obtain information on potential trading counterparts that best fit their preferences. Once trading opportunities are discovered, traders move on to contract formation, such as reaching an agreement on transaction prices. If potential trading parties fail to agree

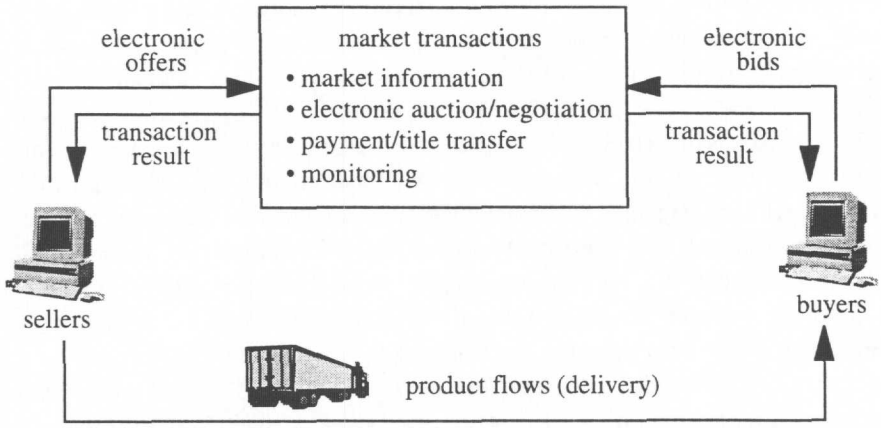

Figure 1. Decoupling of Product Flows from Market Transactions

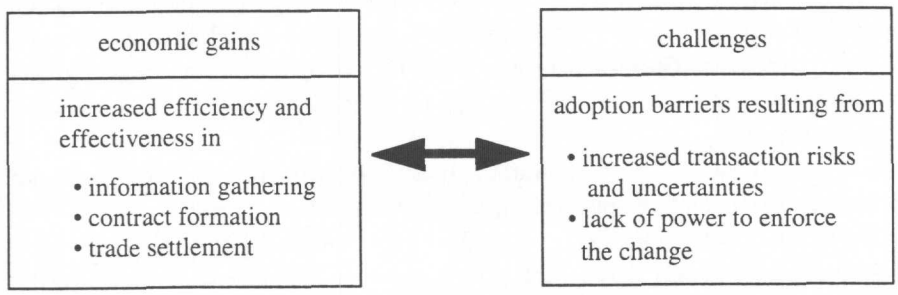

Figure 2. Opportunities and Challenges of Electronic Market Adoptions

on transaction terms, negotiations may have to be repeated with many firms before a contract is finally formulated. Many market-making firms adopt auction mechanisms to expedite this bargaining procedure and to find the market value of goods promptly. The trade settlement process clears transactions through physical exchange of goods and payment. The economic benefits from electronic-market adoptions can be investigated to reveal how IT improves these three transaction processes.

For information gathering, electronic markets typically offer pre-trading and post-trading information that can be accessed by market participants at any time. Traders who could get information regarding available trading partners upon their arrival at the market are now better informed in advance about the prospective trading partners. Furthermore, most electronic market systems provide an electronic bulletin board that displays information on recent transactions, including quantities of products recently sold, product quality characteristics, and prices paid by buyers. This post-trading information keeps traders well informed on the market price of goods with specific characteristics of interest to buyers or sellers, thereby facilitating selling and buying decisions. Since traders can obtain this information and execute transactions without coming to markets, they save both time and money.

For contract formation, sellers in open markets often establish reservation prices for exchanges because they do not have perfect information about the consequences of their actions in markets. The reservation price plays a role as sequentially rational rules under incomplete market information [33]. Suppliers who brought their products to traditional markets often had to accept prices lower than their reservation prices. This is common with perishable products or when the transportation costs of bringing the products back home are high. If product flows are separated from the market transactions, sellers can keep their reservation prices relatively firm unless they urgently need cash for their products. Thus, electronic markets can strengthen supplier power in some market environments, resulting in increased average prices for their goods.

Electronic markets can become a national marketplace by eliminating geographical constraints and can broaden the range of choices for buyers. Traditional markets (such as auctions for agricultural products) typically consist of several regional markets scattered around the country. Regional markets are limited in transaction volume since they need to hold inventory until the moment of sale. The transaction depends on the pool of products held or stored in the regional market. Electronic markets allow the pool of product offers to be enlarged without expanding physical infrastructure, such as storage capacity. The establishment of national, as opposed to regional, markets increases the buyers' chances of finding preferred trading parties in terms of prices and product quality.

Electronic markets can also benefit the trade settlement process. Since goods are delivered directly from suppliers to buyers after an on-line transaction, the transportation logistics from suppliers to the markets are eliminated. Often, direct shipping reduces product damage during packaging, loading, and unloading. Furthermore, the use of electronic markets facilitate electronic auditing, which helps firms monitor transactions.

Barriers of Electronic Market Adoptions

For traders used to coming to a market for exchange of goods, the idea of separating logistics from the market transaction through on-line trading is revolutionary. Anything associated with the new transaction method—institutional rules, market structures, management systems, relationships with member traders, and technical complexity—must be redesigned to accommodate the change. Many member traders' longstanding policies and traditions may be affected, and innovation leaders often encounter resistance from those who prefer the status quo. Market-making firms that initiate electronic market systems are thus likely to face two types of adoption barriers: (1) *transaction risks* created by the new alternative market form, and (2) *lack of the market power* necessary to enforce the change.

Two important assumptions of human behaviors in transaction-cost analysis are bounded rationality and opportunism, which result in the risks and uncertainties of transactions in open markets [37, 38].[4] As discussed earlier, one of the primary functions of market-making firms is to reduce transaction risks through institutional rules. However, the adoption of electronic markets is likely to increase transaction

risks or uncertainties. For instance, buyers have to make purchasing decisions based on information without physically inspecting products, thus facing the risk of incomplete and distorted information. Sellers may doubt that their goods would be appropriately valued in the unproved market system, particularly when there is a strong possibility that they would suffer from lower prices due to inactive trading at the newly created electronic markets. When market participants perceive these risks or uncertainties involved with the change exceed the benefits expected using the new approach, they will be reluctant to adopt the new transaction process.[5]

BPR generally requires a top–down approach [14, 18]. The inertia of old processes and structures often makes it extremely difficult to introduce radical changes. BPR therefore needs to be initiated by top management, who has the authority to lead the reengineering through the organization. Market process reengineering is also likely to encounter resistance from market participants. The resistance may be nothing more than inertia, but it also stems from a healthy suspicion of new and unproved market systems. Furthermore, parties affected adversely by the change are expected to fight reengineering efforts. Unlike BPR within a firm, however, market-making firms can hardly impose a top–down style of reengineering. Although they can initiate the reengineering process, market-making firms generally lack sufficient power to force adoption. Without the active participation of member traders, the reengineering effort is doomed. The only way for market-making firms to achieve their reengineering objective is to convince their member traders of benefits of the new process.

The next two sections discuss four cases of electronic market adoptions—their economic incentives and adoption barriers, respectively—within our research framework. The data are gathered from interviews as well as secondary sources. Two cases (CALM and AUCNET) were published as successful adoptions in the early 1990s [6, 36]. Although our analysis refers to these publications, further data have been gathered by interviews, in particular from the market process reengineering perspective. The analysis for the two failed cases is based on interviews and internal documents from the companies involved in these efforts.

Economic Forces of Electronic Market Adoptions

THIS DISCUSSION OF FOUR CASES FOCUSES ON MARKET PROCESS REENGINEERING (how electronic markets have brought innovation to traditional market transaction processes) and its resulting economic gains (increased market efficiency). The improvement of transaction effectiveness and efficiency, enabled by electronic market systems, is investigated along the three transaction process dimensions discussed above: information gathering, contract formation, and trade settlement. Table 1 compares the four cases in terms of trading items, traditional transaction methods, initiating market-making firms, operation period, system throughput, new price discovery methods, and their evaluations. The observed values of the electronic market adoptions are summarized in Table 2.

Table 1. Four Cases

	CALM	AUCNET	IA	CATS
Traded items	Livestock (cattle, sheep/ lambs, pigs)	Used cars	Potted plants	Fresh meat
Traditional trading method	Saleyard auction (on-site auction)	Auto auction (on-site auction)	Flower auction (on-site auction)	Negotiations/ formula pricing
Market-making firms	Australian Meat and Livestock Corporation	AUCNET Inc.	VBA (the largest flower auction in Holland)	American Meat Exchange
Operation period	July 1987– present	June 1985– present	January 1994– October 1995	June 1981– June 1982
Throughput	2.1 million livestock heads in 1995	232,000 cars listed in 1995	10 percent of transaction for potted plants within VBA	109 transactions during the service
Pricing in electronic markets	Electronic auction	Electronic auction	Dutch auction	Electronic negotiation
Evaluation	Success with growth rate of 20 percent in throughput	Success with growth rate of 26 success in throughput	Failed adoption (ceased operation)	Failed adoption (ceased operation)

CALM for Livestock Trading in Australia

The pastoral industry remains important to Australia, which is the largest beef exporter in the world and has the largest sheep population of any country. Australia currently has a population of about 26 million cattle, 121 million sheep/lambs, and 2.7 million pigs. In 1995, about 10 million cattle, 34 million sheep/lambs, and 5 million pigs were traded at US$4.1 billion. The profitability of the pastoral industry depends on effective and efficient trading in livestock. The need to sell many animals several times during their lives increases the importance of effective livestock trading within the pastoral value chain.[6]

Livestock is traded among local producers; there is also farmgate trading where traveling buyers negotiate contracts with producers on-site. This offers the producer convenience but does not necessarily result in a competitive price. Thus, for many years, the dominant mechanism for livestock sales has been saleyard trading where farmers can market their products through face-to-face auctions. There are over 100 saleyard auctions throughout Australia. Suppliers are typically local farmers who bring their products to auctions for sale. Buyers are usually meat exporters/processors, wholesalers, meat retailers (supermarket chains), and agencies that purchase the store stock for their client farmers.

Table 2. Observed Economic Gains (Increased Market Efficiency)

	Information gathering	Contract formation	Trade settlement
CALM	Market intelligence service (post-trading information) facilitates traders' selling and buying decisions	Farmers are no longer forced to sell their products at prices lower than reserve prices Buyers have more choices than in regional saleyard auctions	Direct shipping from farmers to buyers reduces transportation costs and damages to products
AUCNET	Auction schedule distributed in advance saves dealers' time involved with bidding Dealers can download the images/data and talk with clients about offered products	Trading volume can be increased without parking spaces at auction sites Buyers enjoy more vehicle choices not available in traditional auto auctions	Unsold vehicles do not have to be brought back to sellers' locations
IA	Pre-trading information enables wholesalers to consult with retailers and to establish a bidding strategy in advance	Growers can keep reserve prices firm Buyers can specify packaging requirements before delivery	Growers' direct delivery to buyers relieves auction of storage and traffic problems
CATS	Traders can browse listed bids/offers to select trading counterparts Summarized information on transaction history helps traders negotiate prices	Nationwide database of bids and offers induces more competitive market prices than formula-based pricing Small firms can bypass brokers for transactions	

In the early 1980s, Australian Meat and Livestock Corporation (AMLC), an industry statutory authority responsible for marketing livestock in Australia and overseas, initiated a reengineering project for the livestock trading process [6]. The objective was to establish a network for electronic sale of cattle, sheep/lambs, and pigs in order to improve market efficiency and the match between product characteristics and market demands. After a trial system in 1983 in the New England region, AMLC formed a new division in 1985, Computer Aided Livestock Marketing (CALM), to lead the industry toward electronic market systems. CALM service was commercially launched in July 1987.

CALM is an electronic auction system for buying and selling cattle, sheep/lambs, and pigs on the basis of product descriptions, while the stock remain on the farmers' property or feedlot. Buyers can bid electronically from anywhere in Australia. Traders

link their workstations to the central computer using Telecom Australia's X.25 packet-switching network. To list a lot on a CALM auction, a vendor arranges for a CALM-accredited assessor to prepare an assessment of his or her lot. The information about products that will be auctioned off is normally released one clear working day ahead of the auction. The electronic auction takes the format of either sequential auction or simultaneous auction [6]. Once sold by CALM, the products are shipped directly to buyers.

CALM has significantly reduced the cost of obtaining market information on livestock trading. CALM market intelligence service, available since mid-1991, comprises a number of components, including statistical reports on CALM transactions, historical trends in CALM sale prices, and market commentaries on domestic and overseas market details. During the contract formation, CALM has decreased the pressure on the producer to sell at whatever price is being offered at the saleyard because failure to sell does incur effort or cost for returning the stock to their feedlot. CALM listed over 2.1 million livestock in 1995, far more than were offered in any single regional market, thus enabling buyers to purchase products that better fit their preferences. Finally, the livestock does not have to travel to a saleyard in CALM; thus, there is no transportion cost of bringing the stock to the saleyard. This lowers the stress on the animals and reduces handling and the resultant bruising, and so brings higher-quality product to the buyer.

Since CALM service was launched, the number of livestock traded through CALM has increased at a compound annual growth rate of 20 percent. In 1995, CALM sold 234,000 cattle, 1,840,000 sheep/lambs, and 82,500 pigs through the electronic auction, with just 252 employees. This transaction accounts for US$109 million (60 percent for cattle, 32 percent for sheep/lambs, and 8 percent for pigs). The CALM throughput is expected to grow at over 15 percent per year during the next decade, further penetrating the traditional saleyard auction trading.

AUCNET for Used-Car Trading in Japan

Japanese consumers generally purchase second-hand cars from licensed dealers. A complex web of title registration and regulation makes direct trading of used cars between individuals difficult. Avoiding the risks of hidden defects and securing financial loan also lead Japanese consumers to prefer dealing with reliable and substantial used-car dealers. If a vehicle desired by a consumer is not in his inventory, a used-car dealer typically goes to the auctions, rather than rely on his competitors' inventory. In 1995, over 3.6 million used cars worth ¥1,482 billion (US$15 billion) were sold through 144 auto auctions in Japan.

In a traditional auto auction, vehicles, buyers, and sellers are assembled at auction sites. Traders are typically used-car dealers who either seek vehicles for their clients or wish to sell trade-ins. Cars are brought onto the auction floor one at a time, and buyers bid by holding up their hand. Although cars are inspected prior to the auction by auto mechanics, an estimated 80 to 90 percent of the buyers personally inspect the cars prior to the auction. Thus, the product flow is coupled with the auction process.

AUCNET was introduced in 1986 by an entrepreneurial used-car dealer who realized that computers and advanced communication technology could eliminate an immense amount of time wasted in the search for cars. The AUCNET system is a centralized on-line wholesale market in which cars are sold using video images, character-based data, and a standardized inspector rating [36]. Sellers must have their vehicles inspected by AUCNET mechanics, who assess damage and summarize the quality rank in a single number (from 1 to 10). A car sold through AUCNET remains at the seller's location until the transaction is completed. Then a transport company typically delivers it directly to the buyer. During the electronic auction, sellers and buyers are linked to AUCNET's central host computer via satellite.

AUCNET's advantage over traditional auto auctions is its ability to help dealers gather information. Attending conventional auto auctions is time-consuming. Because there is no precise schedule for when certain cars will be sold, a dealer might spend an entire day at a traditional auction to bid on one or two cars. Since used-car dealers usually are salespeople themselves, they lose sales opportunities while attending traditional auctions. Since the AUCNET auction schedule is distributed in advance, used-car dealers can download the data and images of offered cars through the satellite network and can limit their time spent in the auction process to only the cars they are interested in buying. Dealers can also show the information to customers and include these cars in their bidding list based on clients' requests.

Most traditional auto auctions in Japan are held in metropolitan areas where parking spaces for used-car sales is becoming increasingly sparse and expensive. Traditional auctions therefore are limited in the number of used cars they can accommodate for sales. AUCNET created the largest auto auction without using a single parking space; in 1995, it listed over 230,000 used cars. AUCNET can easily accommodate increasing sales volume, with an expected annual growth rate of 15 percent projected over the next five years. As a result, buyers in AUCNET enjoy greater vehicle choices than are available in regional auto auctions and for this reason are willing to pay higher average prices. Furthermore, used-car sellers in the past had to carry significant transportation costs to move a car to the auction site and back again if it was not sold. About 45 percent of cars brought to the auto auction sites remained unsold. AUCNET eliminated such costs by decoupling the logistics from the market transactions.

With these advantages over traditional auto auctions, AUCNET's throughput has increased at an annual compound growth rate of 26 percent since its initial operation. In 1995, when AUCNET listed over 230,000 used cars, the company recorded an operating profit of ¥1.8 billion (US$18 million) on sales of ¥6.1 billion (US$61 million) with just 136 employees. The membership network among dealers has continued to expand at a rate of about 100 per quarter, reaching 4,150 at the end of 1995.

Information Auctioning for Potted Plant Trading in Holland

The florist industry, associated with the cultivation and trading of cut flowers and potted plants, is a major economic sector in the Netherlands. The Dutch flower

industry, which has almost an 80 percent share of the world export market, produced over US$ 3.5 billion transactions in 1995. Auction organizations, which are typically cooperatives of growers and are obliged to sell all their member farmers' products through their auction processes, are key institutions for coordinating global supplies and demands. For example, Bloemenveiling Aalsmeer (VBA), the largest auction market with 43 percent of market share of eleven flower auctions, is a cooperative of about 5,000 growers. Buyers are typically large organizations, such as exporters, wholesalers, and retail chains.

Because cut flowers are perishable goods, fast market transaction and delivery are vital in the supply chain. In traditional flower auctions, cut flowers and potted plants are brought to the market the night before the auction. Upon arrival, products are inspected by the auction's own inspectors (the flower master) and kept in large cooling areas until the moment of auction. The flower master's inspection remarks are recorded in computers so that they can be displayed during the auction. The auction normally starts early in the morning and continues until all the products are sold by Dutch auction rules, where an auctioneer begins by asking a high price and gradually lowers the price until some bidder takes the offer. Cut flowers and potted plants are carried through the auction hall during the auction so that buyers can make purchasing decisions based on what they see. After sale, the lots are driven out and loaded into vans or trucks arranged by buyers. In this way, products auctioned in the morning can be sold the same evening or the next morning at florists and retailers in Europe, North America, and practically any other part of the world.

In January 1994, VBA launched Information Auctioning to reengineer the traditional auction process of potted plants [23]. The sheer scale of individual transactions required large storage spaces and generated substantial traffic to and from the VBA auction house. VBA realized that this traffic would be unmanageable within the decade, given a 10 percent annual growth rate, since the available space for expansion was already nearly exhausted. The objective of Information Auctioning was to separate the logistics of potted plants from the auction process. In Information Auctioning, growers send a sample, rather than the entire quantity available, along with information about the main supply to VBA. Buyers bid for the main supply based on the product sample in auction halls. The main supply remains at growers' locations to be packaged and shipped to the buyer after transactions are completed. Growers, buyers, and auctions use electronic communications to coordinate all the information exchanged in this process.

Information Auctioning does not completely separate product flow from the market transactions. A sample lot of the offered product must still be sent to the market and buyers still personally attended the bidding at the auction halls. VBA decided to adopt this approach in order to work as practically as possible within existing transaction conventions. Because it is difficult to describe florist products electronically, VBA feared that buyers might balk at a radical transition to completely on-line trading. VBA assumed that Information Auctioning would serve as a milestone for its long-term reengineering goal of completely separating logistics from market transactions.

Information Auctioning enables buyers to browse the entire database of offered

products the day before the auction. This contrasts with traditional auctions, where buyers could get the information of available products only on the day of auction. This pre-trading information is a significant benefit to wholesalers (buyers). The prices of cut flowers and potted plants change significantly day by day depending on supply and demand, often varying up to 20 or 30 percent in sequential trading days. Wholesalers (buyers) can communicate with retailers based upon this information to come up with bidding strategies, such as what to buy, how many lots to buy, and how much to pay.

In traditional auction markets, growers have to sell out their perishable products regardless of the market price received. Since Information Auctioning decouples the product flows of the main supply from the market process, a grower can keep his reservation price relatively firm. If no buyer is willing to pay higher than the grower's reserve price, the grower may withdraw the products from the market and offer them again later on, since products are not harvested until sold. In return, buyers benefit because they can specify the packaging requirement for delivery.[7] Information Auctioning also expected to resolve storage and traffic problems for VBA. Direct delivery of goods from growers to buyers would allow VBA to increase its transaction volume without expanding its physical storage capacity.

Despite all these expected benefits, however, the penetration rate of Information Auctioning was disappointing for the first several months of operation. VBA undertook various rule changes to induce traders to switch to the new transaction method. Even so, Information Auctioning executed only 10 percent of the product sales—much less than the planned goal of 45 percent. VBA officially stopped the Information Auctioning service in September 1995. VBA encountered unexpected resistance and failed to deal with the barriers it faced; these are discussed later.

CATS for Meat Trading in the United States

Wholesaling is a vital link in the marketing process of the U.S. meat industry. Wholesale trading of fresh meat takes place for a variety of reasons. Because of the perishability of the meat products, the market transactions rely heavily on cooler and holding capacity, which is more easily available in wholesalers. Regulations, such as the late 1920s Consent Decree, prohibit some meat packers from retailing, thus necessitating wholesaling for market transactions. In 1995, over 135 million slaughtered cattle, hogs, and sheep were distributed by wholesalers for domestic consumption and export to foreign markets. In 1981, when CATS was introduced, the U.S. meat industry produced more than 39 billion pounds of meat.

In wholesale markets, fresh meat is generally traded either on a negotiated basis or on a formula basis. A negotiated trade is a transaction where delivery, quality, quantity, and price are agreed on at one time by a seller and a buyer. A formula-priced transaction differs in that the transaction price is based on prices published by a market reporting service on the day prior to shipping.

Formula pricing, which accounts 80 percent of all meat trading, has been questioned on the grounds of market price manipulation and adequacy of market information.

Formula prices are based on prices that are reported voluntarily, and the reporting mechanism involves personal discretion on the part of the market information services. Thus, large firms could use market reporting services to affect prices in a self-serving manner that may be detrimental to other market participants, including consumers and farm producers. Another problem was the adequacy of market information. A large percentage of negotiated transactions is not reported to market reporting services. It is estimated that sales data on less than 2 percent of U.S. federally inspected slaughter is reported to market reporting services [30]. A considerable portion of the market is insulated from use as a source of price information, further increasing the potential of market price manipulation by large firms.

The Computer Assisted Trading System (CATS), an electronic meat trading system at the wholesale level, was introduced in 1981 by American Meat Exchange (AME) to address concerns about the accuracy and adequacy of market information [30]. AME, one of the three market reporting service companies at that time, thought that the redesign of the meat market process using electronic networks would create desirable conditions for a competitive market and greater pricing efficiency. In CATS, a trader could place bids and offers using terminals connected to the central computer through local telephone or toll-free WATS lines. This order information was then made available to all other eligible traders. Unlike the other three cases discussed here, however, all of which employ auction mechanisms for discovering value of goods, the transaction price in CATS was determined by several rounds of electronic negotiations. The electronic communications between trading parties continued until either a transaction was consummated or a party withdrew from the negotiation.

CATS enabled traders to review selected bids and offers and helped them obtain pre-trading information. It also supplied traders with daily transaction information, a chronological (or otherwise sorted) listing of transactions for each region, and a summary of price and quantity information for each item. Price and quantity information was summarized for product and transaction type to facilitate the traders' market analysis.

CATS was expected to resolve the *thin* market problem of formula-based trading by increasing competition among buyers and sellers. Since CATS was capable of connecting many buyers and sellers, and reporting market information to traders regardless of their geographical location or market power, it was expected to *thicken* the market and to provide competitive pricing. In addition, CATS was intended to allow traders to bypass brokers to locate potential trading partners. AME thought that this would encourage relatively small farmers and buyers, who relied on brokerage agencies, to join the system and that it would result in more fair and competitive pricing than formula-pricing, which was dominated by a few large firms.

The AME's electronic market adoption, however, failed. AME launched the CATS service in June 1981 and suspended its operation in November of the same year. During this period, 981 bids and 1,693 offers were placed and 109 transactions were executed through the CATS. The disappointed AME officially terminated the CATS operation in June 1982. Like Information Auctioning, AME failed to foresee and prepare for certain barriers and resistance to new electronic market adoptions.

Analysis of Adoption Barriers

MARKET-MAKING FIRMS INITIATED THE ELECTRONIC MARKET SYSTEMS with clear visions of their potential economic benefits. Why, then, did Information Auctioning and CATS fail, despite tangible benefits comparable to those of CALM and AUCNET? The difference between successful and failed adoptions lies in the management of barriers introduced by the change. We identify three types of adoption barriers that prevent market-making firms from implementing successful electronic market systems. Table 3 summarizes observed barriers or uncertainties that result from the establishment of electronic marketplaces in these four cases, together with tactics employed to reduce these barriers by the initiating market-making firms.

Electronic Product Description

Market process reengineering requires that buyers purchase products from descriptions (information) without physically inspecting them. This creates new uncertainties for buyers since it can magnify information asymmetry.[8] If the market-making firms fail to ensure that product information properly reflects the original products or if they are not equipped to protect buyers from misinformation, buyers will resist the new system. Product evaluation (inspection) becomes a challenging task when product flows are separated from market transactions. Unlike traditional markets, where all products are brought to a central site and can be easily inspected, initiating market institutions need to decentralize their inspection structures for market process reengineering.

The major concern of CALM developers was that product misinformation in the system might discourage buyers from purchasing livestock based on the information provided. To address this issue, AMLC established the Authority for Uniform Specification of Meat and Livestock (AUS-MEAT) in 1985 to focus on quality standards and provide accurate and consistent descriptions of livestock. CALM requires that all supply lots be inspected by CALM-accredited assessors who describe the quality of livestock using four-level standard measures. CALM's institutional rules also include arbitration procedures that can be used to resolve disputes arising from product misinformation.

Standard car ratings and rigorous inspection processes have been fundamental to the success of AUCNET. Used-car sellers must have their vehicles inspected by AUCNET mechanics. The inspection results are summarized in a single number, between 1 and 10 (10 indicates a new car; 5 or 6 could be resold to the consumer without additional work). For most buyers, this number is the key decision variable when buying a car, even though they may have access to more detailed inspection results. In addition, AUCNET targets relatively high-quality cars in an attempt to further reduce buyers' risks. A car rated lower than 4 cannot be sold on AUCNET. The average price of a car sold on AUCNET is ¥1,280,000 (US$13,000), compared with ¥670,000 (US$7,000) for traditional auctions; these numbers indicate that the vehicles sold in AUCNET are relatively late model.

Table 3. Adoption Barriers and Tactics to Overcome Them

	Observed barriers	Tactics to overcome them
CALM	Transaction disputes over misinformation of products	Establishment of AUS-MEAT for standard product descriptions and on-site product inspection
	Thin market may result in transaction penalties for both farmers and buyers	Industrywide commitment and promotions
AUCNET	Buyers may mistrust electronic description of used cars	Standardization of car inspection and rigorous inspection process
	Retaliation from JUCDA	Antitrust complaints and publicity
IA	Quality uncertainty of offered products	Use of sample lots to represent the main supply
	Inactive trading may hurt both growers and buyers	Various auction rule changes
CATS	Quality uncertainty of offered products	Use of NAMP's Meat Buyer Guide without on-site inspection
	Resistance from big wholesalers due to their loss of market price control	Resolution of trade disputes through bilateral negotiations between buyer and seller

When VBA launched Information Auctioning, it hoped that the use of samples could solve the problem of product description. Most buyers, however, did not trust the samples to represent the entire product supply adequately: Samples were always assumed to be the best slots out of the main supply. Without well-standardized product rating and inspection for the main supply, the use of samples increased the risk of information asymmetry.

CATS adopted the National Association of Meat Purveyors (NAMP) Meat Buyer Guide to represent meat products whose qualities vary widely depending on cutting methods and specifications. However, CATS had no instruments to check the reliability of data entered by sellers. Buyers had to assume that the description, entered by suppliers, was a proper representation of the offered products. Furthermore, CATS failed to provide the clearinghouse function, leaving responsibility for resolving trade disputes to individual traders.

Thin Market

Traders who take their orders to a new, less active, and less liquid market face uncertain execution and liquidity penalty [9]. In the absence of significant order flow, when their orders will be executed is uncertain. In addition, attempts to buy and sell in a thin market may create an imbalance of demand and supply, which may hurt prospective

buyers or sellers. If the new system fails to provide a critical mass large enough to induce traders to switch to a new market form, traders will not join the system because of economic penalties of inferior execution.[9]

CALM was introduced by AMLC, a statutory authority with the power to lead the livestock industry into electronic trading. AMLC started the CALM operation using funds from the industry levy that applied to all animals slaughtered or exported live in Australia. CALM enjoyed industrywide commitment to its service from the beginning, as well as strong support from the minister and the Department of Primary Industry and Energy. Its active promotions, such as free insurance for products traded over the CALM, also helped CALM promptly achieve the initial critical mass necessary for the impacts of electronic markets to be felt.

Information Auctioning lagged behind its intended market penetration rate because of the lack of significant order flows. Despite its advantages over traditional auctions, the benefits of shifting trading into this new market form were not strongly felt by participants, partly because there were not enough market counterparts. The thin market resulted in lower prices than those of traditional auctions. As a result, growers had to bear costs to modify packaging to suit the buyers but received no extra compensation for their services. In response, VBA established a price floor (minimum price) to reduce price volatility and auctioned the main supply prior to the sample lots in an attempt to make the new market more active. The change of rules, however, did not make the new market active enough to overcome the thin-market problem.

Resistance to Change

The inertia resulting from large investments in existing infrastructures and the reluctance of traders to embark on a new round of organizational learning may serve as barriers to successful implementation of electronic marketplaces. The change of the transaction process using computer and communications technology can generate confusion and discomfort to traders if they have limited IT knowledge. Opponents often argue that traditional markets serve as an important socialization venue and thus cannot be replaced by electronic marketplaces. Moreover, firms affected adversely by an electronic market are expected to resist and oppose the system.

As a new market institution, AUCNET faced retaliation from traditional auction markets which felt threatened by the new system. In the beginning of its service, AUCNET secured about 1,000 reservations from used-car dealers. Then, the Japanese Used Car Dealer Association (JUCDA), which ran most traditional auto auctions, announced it was against AUCNET and threatened that members who joined AUCNET would be stripped of their membership in JUCDA. When more than half of the reservations were withdrawn, AUCNET used antitrust complaints and publicity in the press to get the government to prevent JUCDA from blocking AUCNET.

CATS was introduced by AME, a private company that lacked the market power to enforce the change in the meat industry. It began its services without industrywide commitment. The objective of CATS was to make the market more competitive by reducing the large firms' influence on meat pricing (formula pricing). Large wholesalers,

whose participation was critical to its success, were not enthusiastic about the new process. CATS both lacked regulatory power to overcome the large firms' resistance and failed to offer them strong enough incentives to join the system.

Implications for Management

THE CENTRAL CLAIM OF THIS PAPER IS THAT SUCCESSFUL DEPLOYMENT of electronic markets requires consideration of the barriers resulting from market process reengineering along with the projected economic benefits. To blame immature technologies in the early 1980s for the failure of CATS is unreasonable since the IT used by CATS had already been used successfully by the cotton industry in the TELCOT system, which began operation in 1978 [26]. Likewise, IT was not a major impediment to Information Auctioning, which was launched more recently and used well-proven technologies. Most risks, uncertainties, and barriers stem from social and economic factors, rather than IT-related obstacles. This finding is consistent with many BPR research results [15, 34]: IT is a necessary but insufficient factor for reengineering. The success of electronic market adoptions is as dependent on the management of barriers as it is on the economic benefits enabled by the IT. Some cautious suggestions can be made on the basis of the four case studies to assist market-making firms in the analysis, design, and implementation of electronic market systems.

Standard Product Quality Rating and Inspection

Recent advances in multimedia technology allow more product groups to be traded electronically. Although the use of multimedia representation may help buyers make purchasing decisions, by itself it will not eliminate the product uncertainty encountered by buyers in electronic markets. Before Information Auctioning, another flower auction market in the Netherlands introduced Video Auctioning, where the physical presence of cut flowers was replaced by pictures displayed on a big screen during the auction process [23]. That system also failed. Similarly, Slide Auction was implemented before the advent of AUCNET by traditional Japanese used-car auctions [36]. The Slide Auction, designed to hold auctions by using 35mm color slides, also ended in failure. None of these failed systems provided adequate product quality specifications and assurances.

There are two features that are crucial for reducing the uncertainties involved in product descriptions in electronic markets: (1) certain standards for product ratings, and (2) a trusted party to carry out product inspection. The failures of Information Auctioning, Video Auctioning, and Slide Auction were due to the lack of standardized quality ratings. CATS used an industrywide standard for meat product descriptions but did not employ an inspection procedure to verify the sellers' descriptions. The emphasis on building standard product ratings and rigorous inspection process accounts for much of the success of CALM and AUCNET.[10]

Quick Achievement of Critical Mass

Participation externality affects the dynamics of the introduction and adoption of electronic market systems [24, 25]. The benefits realized by individual participants in an electronic market system increase as more organizations join the system. Without a critical mass of users, an electronic market system is unlikely to spread its usage and may be extinguished. The quick achievement of initial critical mass accounts for much of the success in CALM and AUCNET. Within two years of its operation, CALM listed over 110,000 cattle and 517,000 sheep/lambs, and secured more than 5,000 registered users. AUCNET focused on the participation externality and managed to list over 44,000 vehicles in two years.

CALM was able to accomplish critical mass partly thanks to industrywide commitment and government support. In the case of AUCNET, the new market institution induced a large number of traders to switch to the electronic marketplace by providing strong incentives to join the system without any support from a third party. With or without government support, the planning of strategies to obtain a critical mass of early adopters is crucial so that participation externalities can make the impact of the new process felt.

Preparation for Resistance and Retaliation

In view of the inertia of old transaction processes and structures, the strain of implementing a market process reengineering plan can hardly be overestimated. Since traders need to be aware of the advantages of the new transaction process, education and promotion of the concept, including IT-related technical supports, must be a prominent part of the plan. Opponents of electronic markets often proclaim the disadvantages of electronic marketplaces compared with traditional markets, since traders cannot capture all the market information on traditional transaction methods [28]. In financial trading, for instance, it is important to know who is bidding, who is offering, and who is trading with whom. This information gives a trader some guidance regarding the nature of trading activity and price movements. Thus, initiating firms need to design the electronic market system carefully so that traders can use their terminals to garner as much information as is available (or more) on the traditional trading floor.

Firms that are affected adversely by an electronic market can be expected to fight the system. For instance, AUCNET had to rely on government authority to overcome JUCDA's retaliatory efforts.[11] Retaliation is more likely when there are many firms whose power is relatively equal or when the affected parties are able to unite against the initiating firm. Without a strategy to deal with potential retaliations, the initiating firm may be caught without an appropriate response and therefore jeopardize its investments.

Conclusion

WE EXPECT THE ADOPTION OF ELECTRONIC COMMERCE APPLICATIONS by existing or new market makers to grow rapidly as the cost of communicating information between

firms decreases. We have investigated here the evolution of electronic market adoption by such market-making firms. The implementation of electronic markets is viewed as market process reengineering aimed at decoupling product flow from market transactions through on-line trading. We have taken a close look at how IT-enabled reengineering increases market efficiency as well as barriers.

Firms interested in redesigning market processes using electronic commerce solutions need to plan carefully to overcome adoption barriers that could cast a shadow over the benefits of the proposed new market processes. By examining the barriers and facilitators of success in the case studies presented, market makers can be better prepared to design electronic markets that increase market efficiency and overcome barriers to adoptions.

NOTES

1. Market-making firms can also be established in formats other than the auction. In NASDAQ and the London Stock Exchange, for instance, investors trade with financial intermediaries (dealers) based on dealers' quoted prices. Both NASDAQ and the London Stock Exchange are governed by detailed trading rules, including responsibility of intermediary roles such as affirmative obligations [12].

2. In transaction cost economics, first suggested by Coase [10] and expanded by Williamson [37, 38, 39], transaction costs are used to explain why firms (or hierarchies) emerge. The transaction cost economics suggests that the costs and difficulties associated with market transactions sometimes favor hierarchies (or in-house production) over markets as an economic governance structure. Hodgson [21] employs the transaction cost theory to address the question of why organized markets, or market institutions, are favored against fragmented, less-organized markets, without institutional rules.

3. With open lotteries, nearly 400,000 applications for cellular licenses were received, and the FCC had to bear significant processing costs. Moreover, it required lengthy delays to introduce services since many licenses were resold to other cellular providers. After this lottery fiasco, the FCC used comparative hearings to award cellular licenses in thirty markets, but this took almost two years and millions of dollars spent on lobbying by firms attempting to influence the outcome.

4. In addition to these two behavioral assumptions, Williamson presented three characteristics of transactions—uncertainty, frequency of transactions, and asset specificity—to explain the economic governing mechanisms between markets and hierarchies.

5. Our use of the term "transaction risks" has a narrower, system-oriented focus compared with its use in [7, 8], which study transaction risks extensively in the context of interorganizational information systems. In these previous works, transaction risks are those risks accruing from firms' reliance on coordination with independent partners. In contrast, we address the transaction risks that are newly created as a result of the electronic market adoption within market institutions.

6. Livestock is sold either for slaughter or for breeding stock. Products traded in breeding purposes include store stocks for medium-term resale and feedlotting stocks for short-term resale. These stocks may be resold later in the market by different traders.

7. There are three methods for potted plant packaging. In traditional auctions, purchased products may not be packaged in a way preferred by the buyer. Since products are not packaged yet at the moment of the transaction, buyers in Information Auctioning can specify their packaging preferences before delivery.

8. Akerlof [1] presents transactions in second-hand cars as an example of market with asymmetric information. It would be very costly for a buyer of a second-hand car to determine accurately its true quality. There is certainly no guarantee that the owner of the car would disclose his or her knowledge about its history and quality during the transaction, particularly if the vehicle is a "lemon" that the seller is eager to unload.

9. In the financial-market literature, this phenomenon is called the "liquidity trap" or "central market defense," and represents a crucial economic dynamic for new market designs, including electronic trading systems, because of the importance of the liquidity in financial exchanges [9, 12].

10. Another example is TELCOT, an electronic market system introduced by the Plain Cotton Cooperative Association (PCCA) for cotton trading [26]. In TELCOT, cotton farmers send six-ounce samples of each bale (500-pound cotton package) to the Department of Agriculture, which determines the grades of cotton based on well-standardized measures. The standard attributes assessed by the government enable buyers to purchase cotton before seeing it.

11. The experience of HAM (the Hog Auction Market), an electronic market system for pig trading in Singapore, offers another example of retaliation from affected parties. When HAM was introduced, pig importers, who were afraid of being squeezed out of the pig market process by HAM, understandably protested the system by boycott and legal injunction [29]. The government, convinced that HAM would ultimately benefit local consumers, had to resort to regulatory powers to overcome the brokers' court injunction, which would have killed the HAM system.

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