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Success and Failure Factors for Implementing Effective Agricultural Electronic Markets¹

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Abstract

Despite the growth of research interest into electronic markets, there is still little information available on the ways in which an electronic market can be successfully developed. This paper reports the development of a set of success and failure factors for electronic markets, specifically those within the electronic livestock and crop marketing area. Literature-based cross-case study analysis is conducted to examine and compare specific cases of agricultural electronic markets and explain why some projects succeeded or failed.

The findings of the research project show that a set of success and failure factors can be derived for the development of an electronic market system in the agricultural (particularly the livestock) industry. Further work is needed to establish whether a generic set of success and failure factors can be derived for electronic markets across all industries.

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1. Introduction

The concept of electronic markets dates back to the mid 1940s when the first documented electronic market system, known as “Selelevision”, was used to remote-market Florida citrus fruit (Henderson, 1984). Real developments in electronic markets, however, only started in the late 1970s when the first computer-based electronic market pilot project was initiated (McCoy and Sarhan, 1988). During the history of electronic markets, no great changes have occurred in terms of the concept itself. The only difference has been the medium underlying the market mechanism, which has developed from analogue telephone systems to digital computer networks.

An electronic market separates the negotiating function from the physical transfer of the product or commodity in which the market trades. It can manage buyers’ and sellers’ offers and bids, as well as moving products directly from sellers to buyers. The system is open to all buyers and sellers, regardless of their location — and can provide instant market information to all traders (McCoy and Sarhan, 1988). Electronic markets offer cross-company electronic connections through the telecommunication networks (Malone *et al*, 1987; 1989), which allow sellers and buyers to trade without being present in a physical market, reducing product transportation costs for sellers and travel costs for buyers. The products sold can be transferred from the seller’s location to that of the buyer without the need to transfer the product first from the seller to the market, and then from the market to the buyer (Smith *et al*, 1995).

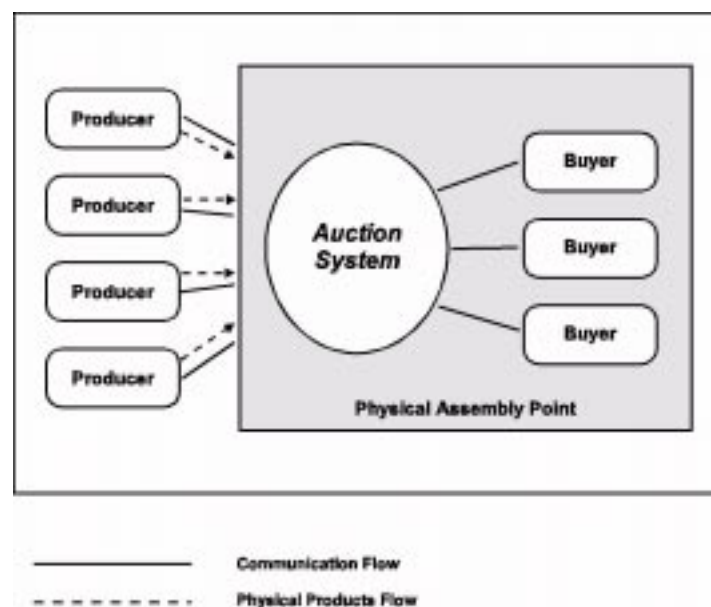


Figure 1: An overview of a physical electronic market

The literature on electronic markets indicates that there are two types of electronic market, but does not attempt to distinguish between them. To clarify this confusion, we have divided electronic markets into two categories :

1. *Physical Electronic Markets* (Figure 1) require the physical presence of buyers at one location at one time to inspect products and participate in competitive bidding in order to acquire ownership of products;

2. *Virtual Electronic Markets* (Figure 2) do not require the physical presence of both sellers and buyers in one location. No inspection by buyers is necessary, because the system works on the basis of “sale-by-description”².

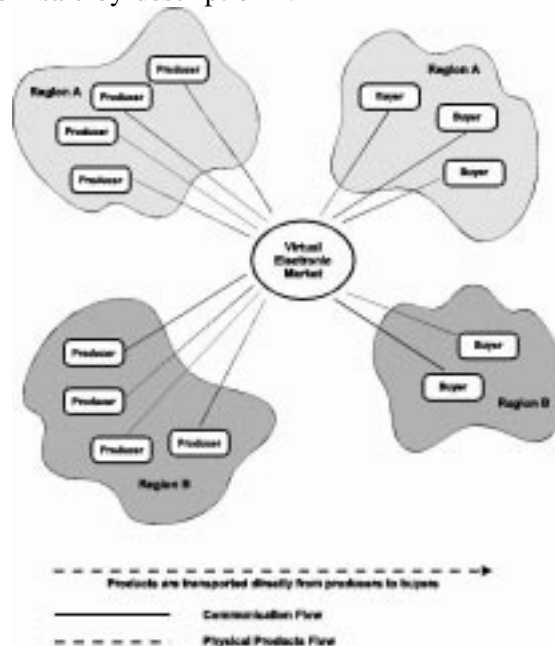


Figure 2: An overview of a virtual electronic market

The traditional literature on information technology and exchange coordination tends to focus on the implications of technology for coordinating the exchange of goods and services. Much of the material available concentrates on two major research themes: research into the effects of information technology on exchange organisations and processes typically applies transaction cost and agency theory to predict shifts from hierarchies towards other intermediate forms of organisations (Bakos, 1991, Malone, *et al.*, 1987, Powell, 1990); the other major approach tends to concentrate on individual case studies — either on pilot programs or commercially successful projects (Clarke and Jenkins, 1993; Clemons and Row, 1991; Konsynski *et al.*, 1989; Neo, 1992; Lindsey, *et al.*, 1990; Sarhan and Nelson, 1983; Sporleder and Davis, 1981).

Despite the growth of research interest in this field, however, there is still little information available on the ways in which an electronic market can be successfully developed. This suggests a need to gain a greater understanding of the nature of electronic markets themselves and, in particular, to identify the factors which underpin success and failure in the majority of cases. To enable a more in-depth analysis of these issues, we decided to restrict our investigation to a particular class of electronic markets: those in the agricultural sector, particularly those relating to livestock marketing. This paper reports the first phase of a long-term research project, presenting a set of initial success and failure factors developed from the investigation of electronic livestock and crop marketing, and possibly relevant to the wider grouping of electronic markets in general.

² “Sale-by-description” involves inspection of the product by an expert third party on the buyer’s behalf. The description of the product is then included in the electronic market system where it can be accessed by buyers.

2. Research Method

The research project reported in this paper was designed to take a systematic and holistic approach to analysing a number of electronic markets, in order to investigate whether a generalised set of success and failure factors existed. While the project would ideally have been undertaken by means of a series of “live” case studies of electronic markets, time and financial limitations necessitated the use of existing literature case studies to develop a framework of electronic markets. Benbasat *et al* (1987) have suggested that “*multiple-case designs are desirable when the intent of the research is description, theory building, or theory testing ... Multiple-case designs allow for a cross-case analysis and the extension of theory. Of course, multiple cases yield more general research results*” (Benbasat *et al*, 1987, p.373). In addition, the use of case studies allows us to gain a deeper understanding of complex environments. This type of research is particularly useful when the research design involves multiple case studies which are intended to provide a basis for making generalisations (Galliers, 1992; Yin, 1989).

Given the lack of existing research undertaken in the area, our aim was to begin building a theory of success and failure factors in implementing agricultural electronic markets. We decided to use multiple case studies by literature survey³ to collect a body of cases which would allow us to engage in preliminary theory building, which could then be extended and tested through further research.

2.1 Research Design and Methodology

The research design integrated results from six literature case studies, which are summarised for easier comparison and presented in a series of tables in appendix A. The case studies examined were:

- TELCOT - Electronic Cotton Marketing (U.S.A),
- HAMS - Hog Accelerated Marketing System (U.S.A),
- CATS - Computer Aided Trading System for wholesale meat (U.S.A),
- CATTLEX - Cattle Exchange (U.S.A),
- HAM - Hog Auction Market (Singapore), and
- CALM - Computer Aided Livestock Marketing (Australia).

(Sporleder and Davis, 1981; Sarhan and Nelson, 1983; Sporleder, 1980; Lindsey *et al*, 1990; Clarke and Jenkins, 1993; Johnston, 1994; Neo, 1992)

All the selected cases document the modernisation of a traditional agricultural market into an electronic version of the traditional market. Among these cases, three (CATS, CATTLEX, and HAMS) were classed as “unsuccessful”, because the pilot projects did not evolve into commercial systems; while the other three cases (TELCOT, HAM and CALM) were considered successful. Although the level of success of these three cases is not yet clear, they all still exist and continue to improve the market features offered. The reason for collecting cases from multiple countries is to understand how cultural factors influence the success of implementing an electronic market.

Cross-case analysis was used to search for cross-case patterns, using divergent techniques. We looked for “within-group” similarities, and “inter-group” differences (Eisenhardt, 1989). The cases involved fell into two different categories: the first comprises the “unsuccessful” cases,

³Sekaran (1992, p37) defines a literature survey as “*The documentation of a comprehensive review of the published and unpublished work from secondary sources of data in the areas of specific interest to the research*”.

and the second group is formed from the “successful” cases. In effect, we looked for similarities among the failed cases and the successful cases, together with the differences between the two groups.

3. Research Findings

After critical analysis of the individual electronic market case studies, we derived an initial set of failure factors to explain the high failure rate associated with such electronic market systems, especially during the 1970s and early 1980s. A set of success factors was also derived from the cross-cases analysis to complement the existing approaches in implementing successful electronic market systems.

These factors are presented in a summarised form below (for more detail see Fong (1997)).

3.1 *Failure Factors for Market Operators*

The failure factors have been drawn from selected cases where the system was terminated. The reasons for termination are extracted and compared with other cases. These failure factors are:

- **Over-developed systems**
Systems such as HAMS and CATTLEX incurred high costs to provide extensive features outside the core function of a market. These features (eg. extensive market related reporting functions, Electronic Funds Transfer, dedicated communication lines) were expensive to develop and were not utilised effectively. The features were costly to implement and could not be justified in economic terms.
- **Lack of SUFFICIENT and ACTIVE market participants**
A critical measure of the success of the electronic market system is the percentage of total livestock sales. It is possible to have a large number of registered users in the system, and yet have only a handful actively participating in trading. Most electronic market systems will not survive without sufficient *active* participants.
- **Dual Marketing**
An electronic market system is one way to market products. But it has to compete with all the marketing alternatives available to the sellers or producers. The traditional marketing methods, such as saleyards, are well entrenched in terms of user loyalty. Thus, although some producers may willingly participate in an electronic market system, they will still use other marketing methods. In reality, only a small portion of their stock is sold through an electronic market system, as was evident in the cases of CATS, HAMS and CATTLEX. Participating in multiple marketing methods will increase selling costs for producers and sellers.
- **Free-riders**
“This free-rider problem referred to those producers who use the price information generated by the pig sale by description to sell direct” (South Australian Workshop, 1982 p.5). The problem of free-riders can be fatal to the survival of an electronic market system, because ownership of the information resources cannot be enforced as information is freely available and trading directly is cheaper for traders.
- **Impersonal nature of an electronic market system**

An electronic market system with remote-access eliminates the social aspect of the trading function, which appears to be important for traders of wholesale livestock. As part of an evaluation of the CATS project, a participation survey was conducted to find out the level of satisfaction among CATS participants. The result showed that participants believed CATS would be improved by direct terminal-to-terminal communication to reduce the impersonal nature of the electronic market system (Sarhan and Nelson, 1983). A similar phenomenon has been observed in remote-access electronic markets in England — particularly in the EASE (Electronic Auction Systems Europe) system. One problem noted by participating traders and farmers is a lack of the social contact which they consider to be highly important (Borman *et al*, 1993).

3.2 Success Factors for market operators

These success factors have been drawn from the selected cases where the system still exists and continues to improve. The reasons for success are extracted and compared with other cases. These factors are useful when conducting strategic planning of electronic markets and include:

- **Market operators should provide basic, core functions initially.**

Commercial viability and growth can occur from low volumes if the initial system is cheap enough to operate and use. As mentioned, HAMS and CATTLEX failed because they were over developed: they were complicated and overly expensive for their target markets, which weren't interested in the extra functionality these systems provided. Although simplicity is usually best, there are circumstances where larger size and sophistication are more appropriate: the optimal starting system for TELCOT was considerably larger and more sophisticated because the system had an initial captive audience within the cotton industry (Rickards *et al*, 1983).

Building an inter-organisational system such as an electronic market system not only involves a commitment from market players, it also requires substantial initial investment in information technology, which can be subsidised by external resources such as government funding. However, the long-term survival of such a system depends on its ability to generate enough revenue to make it economically viable. Large systems are often not cost-effective in their preliminary stages because they are being used to demonstrate potential benefits and gain traders' interest.

High fixed costs incurred by an over-ambitious system scope (ie. provide extensive features outside the basic core function of a market system) should be avoided. In the case of HAMS and CATTLEX, the over-ambitious scope of the systems leading to high fixed costs resulted in their termination, while the more modest aspirations of TELCOT and HAM resulted in a successful conversion to full implementation.

- **Recognising that IT alone cannot produce optimal pricing and efficiency.**

Recognising that information technology alone will not produce the desired effect is critical for the success of an electronic market system. In fact, the strategy used to attract user acceptance is more important than that used to implement the information technology. There is no point in building a technologically-advanced system with inadequate user participation. This is particularly true for an electronic market system which requires industry-wide commitment, rather than a single company to maintain its economic viability. When the benefits of such a system are of a public nature, the beneficiaries may not necessarily be the participants of such a system. The strategic issue of how to maintain such a system is critical.

In the case of HAM, the Singaporean government hoped to use the system to facilitate a transition to open market trading in pigs (hogs) which would ultimately make the market more efficient and benefit local consumers. However, HAM alone could not effect these changes without the regulatory powers of the Primary Production Department (PPD) under the Price Control Act. The government recognised that it could not expect traders to use HAM voluntarily, and tried to provide disincentives for non-use by restricting the use of the Jurong abattoir to HAM-traded pigs. This did not work according to plan, however, and the government had to resort to regulatory powers to overcome a court injunction obtained by a cartel of pork merchants which would have killed the HAM system in its early stages (Neo, 1992).

- **the System should complement the existing value chain for sales.**

Two kinds of electronic market can be found in the selected cases: physical electronic markets and virtual electronic markets (depicted in figures 1 and 2). An important difference is that the latter provides remote access to the market facilities. Both markets can streamline the existing value chain for sales (see Figure 3).

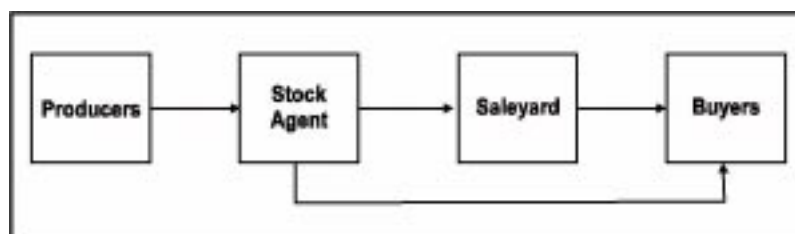


Figure 3: The Existing Value Chain for Sales

In terms of the virtual electronic market, it is possible to replace the role of stock agents by introducing an electronic market system. CALM decided to take advantage of the existing sales channel, rather than trying to shorten the chain by eliminating stock agents. As Millar (1985) points out, the adoption of electronic markets depends on the use of stock agents because producers do not see themselves as marketers. Agents can be used to provide information and advice on marketing for producers.

In CALM, the market operator had strategically positioned agents at the market entry point. The service levels producers required were standardised and progressively fine-tuned, and those who would conform to the standard and were willing to equip themselves with new marketing skills (such as stock assessment) were given the title of Blue Ribbon Agents. A survey by the Australian Council of Livestock Agents (AMLC, 1993) found that the Blue Ribbon title provided agents with a better reputation and encouraged the development of marketing and assessment skills needed for qualification. Also, many blue ribbon agents viewed CALM as a critical long-term facility and a way of improving business. In fact, two-thirds said their businesses had grown because of this title.

What CALM did was to take advantage of the unique position of stock agents to influence producers to sell their stock through CALM. This strategy not only facilitated stock agents moving from the traditional role of commission agents to honest brokers working right through the marketing value-chain, it also enabled agents to add value to clients' transactions by their marketing expertise and stock assessment skills, to meet the needs of traders along the value chain.

- **National government style can determine the success of the system.**

Two government styles in which electronic market systems operated were observed — interventionist and non-interventionist. The style of government and culture of the country may well determine the appropriate implementation approach.

One of the objectives of implementing HAM was to streamline existing channels of communication. Although HAM was successfully implemented in a confrontationist manner, CALM did not seek to adopt such a directly revolutionary and confrontationist approach, but rather worked through existing channels of communication. It appears that both approaches can be successful — the secret is to adopt the correct approach within the particular cultural and economic framework existing in that country at that time.

- **Virtual electronic markets should be integrated into existing sales value chain.**

In order to integrate existing sales channels and increase trading, CALM introduced the concept of the “interface sale” which has become very popular with buyers and sellers. An interface sale takes place at a saleyard or property where an auctioneer puts up lots for sale. The auctioneer accepts bids from those physically attending the sale but, at the same time, a CALM operator is present to transmit bids to other buyers on the CALM network throughout the country. These other buyers can bid through the operator who relays the bids to the auctioneer. When interface sales began, it was anticipated that CALM buyers would account for about 10 percent of total sales at any given auction, even though they would bid on many more. During the years 1991-92, the total sales via CALM at interface auctions were as high as 40 percent, a clear indication of the value of additional competition (AMLC, 1992). It also seems to be an important and strategic step in overcoming the problem of dual marketing.

- **Effective Ownership and Control of the system**

Ownership and control of computerised markets is vital for the success of an electronic market system. A high volume of transactions is perhaps *the* critical ingredient for the development and maintenance of a computerised market. If ownership and control of the computerised market is not shared among market participants from various sectors within the industry, buyers and sellers are likely to ignore the system.

The experience of the CALM system offers further insights into the issues of ownership and control. Because of its inability to hit throughput or profitability targets after nearly 10 years of operation, together with an A\$18 million loss under the subsidy of the Australian Meat and Livestock Corporation (AMLC), CALM was commercialised in 1995. A new, mutually agreed ownership structure was formed to guarantee instant profitability by rapidly expanding its throughput. It would be in every party’s interest to perform effectively and provide incentives to develop higher throughput by shareholders’ influence over the meat industry. Although the full effect of the privatisation is not clear at this stage, it is expected to have a positive impact on throughput sales.

- **Accurate and objective product description is crucial**

All electronic market systems studied except HAM used some form of standardised product descriptions, but the level of comprehensiveness of the standardised product description languages varied from case to case. In the case of CALM, a standard description language was established concurrently with CALM in 1987. This uniform description language was the most comprehensive standard description language of all the case studies. It includes a quality assurance program, quality assessment programs for beef, an accreditation system for market participants and a quality accreditation. The “unsuccessful” electronic market systems (CATTLEX, HAMS and CATS) only adopted the existing grading system to describe the product. Presumably, this could be one underlying cause of insufficient market participants.

- **Statutory government support is important.**

Two of the three successful cases investigated (TELCOT did not fall into this category), indicate that electronic market systems cannot be developed without statutory support, because of the high initial costs and the problem of free-riders, where outsiders can use the system without making any contribution. TELCOT is an exception, because it was completely funded by cooperative members who were eager to see changes in their *main* marketing channels. The single view held by members of the cooperative ensured economic viability.

HAM and CALM were funded and supported by government statute. In the case of HAM, a government-owned company funded the entire project. When the system was implemented, the government changed its statutory regulations to ensure that traders would use the electronic market system. Incidentally, compulsory industry levies were implemented to support the initial running of the CALM system.

4 Conclusions

Developers of electronic markets in the 1970s and the early 1980s failed to position such systems as part of an overall existing marketing system. As most of the users (traders) were still relatively comfortable with the existing conventional marketing systems that provided them with multiple marketing channels, they did not adapt to the electronic market system as predicted. In addition, other failure factors included over-developed systems, lack of sufficient and active market participants, dual marketing, free-riders and the impersonal nature of electronic market systems which led to the termination of many of the systems.

Most successful electronic market systems took a different approach. Instead of using the electronic market system to replace existing marketing practice, the successful systems took a facilitative approach by integrating the electronic market with the existing marketing systems. This proved to be very successful, as the basic core functions of the market were retained. The most significant characteristic of the successful implementations, however, was that in each of the successful cases the electronic market fulfilled a strong, genuine existing need, regardless of any new facilities proffered. In the case of CALM, for instance, which has been running at a loss for over 10 years, the system offered a crucial benefit to farmers (one which was not initially foreseen) — rather than having to transport their cattle to market, which resulted in significant loss of condition for the animals as well as the possibility of the acquisition of illness and disease in addition to the transportation costs, the farmers could leave their cattle in their paddocks. In the case of HAM, the basic underlying need met by the electronic market was a means of circumventing the cartels controlling the price of pork in Singapore — an objective which had strong, unified support from the government and consumers. TELCOT was successful because of the single objective held by the members of the cotton growers cooperative: to enable changes in their main marketing channels.

We believe that the results of this research project have provided a theoretical contribution to the emerging literature on electronic markets. The development of a set of success and failure factors offer a preliminary foundation for further work:

- This research project has reported on success and failure factors derived from documented past experiences. Further research is now needed to evaluate the applicability of the factors we have identified. It is vital to investigate whether this set of success and failure factors would hold true in the implementation of other, new electronic markets — or whether further refinement is necessary before this can become a generic set of success and failure factors.

- The comparative influence of “high-end technology” versus “low-end technology” cultures was inconclusive: further research is needed to establish whether a set of generically applicable factors can be determined, or whether government policy and culture (for instance) mean that success and failure factors for electronic markets must be determined on a case by case basis.
- The scope of this research has thus far been restricted to agricultural (livestock and cotton) electronic markets: therefore its findings cannot be generalised to cover the implementation of successful electronic markets across all industries. Further work needs to be done in a variety of industries, with different levels of technology — and in different countries to obtain a deeper understanding and a more complete coverage. Moreover, this set of success and failure factors has been predominantly extracted from ‘high technology’ countries where the extensive use of computer technology is accepted as part of every day life. A cross-cultural study into a less technologically-oriented country (China) has just been completed to provide indications as to whether this set of factors would hold true in that environment. Hopefully the results from this study will be able to provide a more precise prerequisite of the success or failure factors in all facets of electronic markets.

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APPENDIX A: CHARACTERISTICS OF THE ELECTRONIC MARKETS ANALYSED.

	TELCOT	HAM	CALM
Operating Country	U.S.	Singapore	Australia
Commodities Traded	Cotton	Hogs	Lambs, Hogs, Cattle, Sheep
Operating Organisation	Plains Cotton Cooperative Association.	Hog Auction Market Pty Ltd	Australia Meat and Livestock Corp.
Purpose	Commercial	Commercial	Commercial
Source of Capital	Private	Public	Industry Levies
Operational Period	Since 1975	Since 1990	Since 1987
Market Area for Sellers	Texas, Oklahoma	Malaysia and Indonesia	National
Market Area for Buyers	National	National	National
Type of Pricing System	Sealed bid, firm offer	Open Bidding (English Auction)	Revealed or concealed bid and English Auction
Differential % of Throughput between first year sale and year sale dated in 1995	91.8 % Increase * Calculation based on the period from 1975 to 1984	70.5 % Increase	88% Increase for Cattle 91% Increase for Sheep 21% Decrease for Lambs 93% Increase for Pigs
Market Share as compared to other marketing methods as in 1994	—	64.1 %	4.2 % of Cattle 3 % of Lambs 7 % of Sheep 60 % of Pigs
Overall approach to gain users' acceptance	Facilitative	Threatening	Facilitative

Table 1: The commercially-successful electronic agricultural markets

Evaluation Category	TELCOT	HAM	CALM
Trading Volume	Increase	Increase	Increase
1. Pricing Efficiency Degree of market thinness (depth) 2. Quality of current price 3. Timeliness of market information	<ul style="list-style-type: none"> • Low • Unknown • Instantaneous 	<ul style="list-style-type: none"> • Low • Improved • Instantaneous 	<ul style="list-style-type: none"> • Low • Improved • Instantaneous
Design Acceptability	Strong	Strong resistance at the start, but acceptance of users gained unwillingly at the end	Slow but gradual
Structural Impacts <ul style="list-style-type: none"> • Degree of change on marketing channel 	Modest <ul style="list-style-type: none"> • Electronic system facilitated the existing marketing channel 	Strong <ul style="list-style-type: none"> • Electronic system streamlined the existing market and eliminated non-value-added participants 	Modest <ul style="list-style-type: none"> • Electronic system facilitated the existing marketing channel

Table 2: The evaluation result of successful electronic markets — adapted and amended evaluation guidelines from Sarhan and Nelson (1983)

	CATTLEX	HAMS	CATS
Operating Country	U.S.	U.S.	U.S.
Commodities Traded	Feeder Cattle	Hogs	Meat
Operating Organisation	Texas A&M University, College Station TX	Ohio State University and Producers Livestock Assoc Columbus OH	University of Illinois, General Electric Information Services
Purpose	Pilot	Pilot	Pilot
Source of Capital	Public	Predominantly public	Predominantly private
Operational Period	Sep. 1980 - Nov. 1981	Nov. 1980 - June 1981	June - Nov. 1981
Market Area for Sellers	Texas	Ohio, Indiana	National
Market Area for Buyers	Texas	Eastern States	National
Type of Pricing System	English Auction	English, Dutch Auction	Private Negotiation, open bidding for subsequent system
Differential % of Throughput between first year sale and year sale dated in 1995	—	—	—
Market Share as compared to other marketing methods as in 1994	—	—	—
Approximate sales volume	2400 heads	180,000 heads	95 carloads
Overall approach to gain users' acceptance	Facilitative	Facilitative	Facilitative

Table 3: The commercially-unsuccessful electronic agricultural markets

Evaluation Category	CATTLEX	HAMS	CATS
Trading Volume	Low	Low	Low
Pricing Efficiency 1. Degree of market thinness (depth) 2. Quality of current price/ market information 3. Timeliness of market information	<ul style="list-style-type: none"> Unknown Improved Instantaneous 	<ul style="list-style-type: none"> Unknown Improved Instantaneous 	<ul style="list-style-type: none"> Unknown Improved Instantaneous
Design Acceptability (Acceptance of the system features)	High	High	Low
Overhead cost of system features	High	High	Low
Structural Impacts <ul style="list-style-type: none"> Degree of change on marketing channel 	light	light	light

Table 4: The evaluation results of unsuccessful electronic markets (adapted and amended from Sarhan and Nelson, 1983)