

# **The Construction of Electronic Markets**

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This thesis is wholly the work of the author, except where referenced.

## **ABSTRACT**

The scope of this study is the development of electronic market systems in agricultural products and fish. These systems allow buyers to bid remotely in auctions without attending, based on descriptions of the lots. The study uses a social network approach to uncover the processes by which groups of sellers, buyers, existing intermediaries and technical experts build the electronic market systems and then use them. The research was based upon a survey of literature describing electronic market systems and empirical studies of the developers and users of electronic market systems in the United Kingdom, Iceland, Australia, Canada and the United States of America.

From these studies, patterns shaping the development of electronic markets are identified. The hard technology of hardware and software is shown to be unproblematic relative to the social barriers of gaining acceptance within a trading community. The first social barrier faced in the transition from live to remote markets is the specification of a system for describing the lots for sale. While the justifications for electronic markets stressed the opportunity to restructure agricultural supply, introduce improved price discovery mechanisms and create markets covering larger areas than live markets, the history of electronic markets shows that markets building upon existing social structures are more successful. By enrolling existing intermediaries and simulating the practices of the live market they are able to exploit the trust and expertise embedded in existing social relationships.

The case studies lead to a questioning of the dominant view of electronic commerce - that the technical feasibility of trading electronically and its apparent efficiency advantages over conventional trade make its introduction inevitable. Instead, the limited success of electronic markets in agricultural products suggest that the barriers to the formation of electronic markets are greater than an economic analysis would suggest and that the social impacts of electronic markets are less extensive than expected.

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# 1. Introduction

## *Chapter 1*

Electronic Markets in Agricultural Produce

## **Introduction**

This chapter provides an introduction to electronic markets. The concept of electronic markets is explained and its potential to address perceived weaknesses in existing markets is explained. In the second half of the twentieth century established auctions were being eroded by the growth of direct buying by processors from producers and, as the processing industry became increasingly concentrated, analysts began to question the efficiency of local auction markets dominated by a small number of buyers. Electronic auctions, in which buyers bid across a computer network, were expected to increase competition in markets, reduce the costs of transporting stock and give more accurate price information.

## **The Information Society and Electronic Commerce**

The expectation that information technology will have radical social impacts has been culturally pervasive for over twenty years (Nora & Minc, 1980; Toffler, 1980). Bell (1980) claimed: *"The really major social change of the next two decades will come... as the merging technologies of telephone, computer, facsimile, cable television and video discs lead to a vast re-organisation in the modes of communication between persons; the transmission of data; the reduction if not the elimination of paper in transactions and exchanges; new modes of transmitting news, entertainment and knowledge; and the reorganisation of learning that may follow the expansion of computer-interaction and the spread of video discs"*(Bell, 1980, p533). This expectation has been picked up and developed within public policy in the United States and Europe. In describing the Clinton administration's policy to support the National Information Infrastructure (NII), Kalil (1997) of the White House argued that *"all firms will have to use information and communication technology to lower costs, improve quality and reduce time to market."* Similarly, in the same volume of papers, Niebel (1997) of the European Commission argued that *"a revolution is coming based on information"*.

The Bangemann report for the European Council predicted that the application of information technology and communication networks will have far-reaching social and economic effects, proposing that an Information Society was appearing (European Council, 1993). One element of the predicted Information Society was to be the emergence of electronic commerce, in which commercial transactions, whether between individuals and retailers or between firms, would switch from paper, telephone and face-to-face interaction to the use of electronic networks. For the authors of the Bangemann report this process was irresistible, the *"only question is whether this will be a strategic creation of whole Union, or a more*

*fragmented and much less effective amalgam of individual initiatives by Member States*". This belief in the inexorable development of electronic commerce is also embodied in the US government's popularising of the concept of the Information Superhighway (Kalil, 1997). For proselytisers for electronic commerce the lower costs of processing transactions electronically and the benefits for buyers and sellers of using electronic networks to connect to customers around the world make the advantages of electronic commerce self-evident and its adoption certain. For example, Kalatoki and Whinston (1996, p2) claim the Information Superhighway will "*fundamentally change the way business is done*". This Information Systems discourse is validated by the past falling cost of hardware and the visible encroachment of computers into daily life. One element in electronic commerce is the creation of open electronic markets - electronic networks providing a forum for dispersed buyers and sellers to trade in a virtual market.

### **Electronic Markets**

Bell (1980, p 511) claims that the lower communication costs of the nascent information technologies would affect markets<sup>1</sup>. An electronic market may be seen as a means of widely publishing information, both about the lots for sale in the future and about the prices achieved in the past. A significant approach for analysing the benefits of electronic markets was provided by models of the economics of information. Rees (1966) identified that the search for information in a market has two dimensions. At the extensive margin the buyer seeks another quotation, whereas at the intensive margin the buyer seeks additional information about the item he is considering. For Rees, extensive information search is more important where goods are highly standardised and intensive search more important where there is high quality variability. Within this model electronic markets are complex: most obviously the wider spread of electronic markets relative to physical markets lowers the cost of more extensive market search, but the need to describe the stock in the electronic market impacts upon the intensity of buyers' searches. Stigler (1961) recognised that the wide dissemination of information leads to an increasing reduction in search costs for buyers and as such would increase the consistency of prices within the market. While Stigler was considering the impact of advertising on search costs and prices, the same argument is valid for an electronic market. While Stigler's model is based on the costs of extensive search, he also noted that product quality influenced search decisions, but did not include quality in his model because of the lack of a rigorous definition of quality. For Stigler, quality issues were not solely related to intensive search but were also linked to reputation, which he defined as 'the persistence of quality', with the reputation of sellers affecting the optimal extensiveness of search. In this Stigler identifies the weakness of his formal

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<sup>1</sup> "*In a price and market economy, the condition for efficiency, or optimal use of resources, is complete information among buyers and sellers, so that one obtain the "best" price for one's goods or services*" (Bell, 1980, p 511)

model, which assumes that buyers blindly search for a lower price until the marginal expected value of a further quotation becomes negative, recognising that trade relationships are not transient interactions but that search decisions are influenced by past experience and other sources of information on reputation. According to Stigler, price dispersion is a manifestation of ignorance in the market, so an electronic market should lead to greater price consistency. Stigler also suggested that electronic markets would have a tendency to become monopolies because *“since the cost of collection of information is approximately independent of its use, although the cost of dissemination is not, there is a strong tendency toward monopoly in the provision of information.”*

Bakos (1991), applying the search costs approach of Stigler to electronic markets, listed five points that characterise an electronic market:

1. costs of obtaining information are reduced and users have access to a wide community of alternative buyers and sellers at no great additional cost. This reduces monopolistic/monopsonistic power relations in vertical markets and allows buyers to locate appropriate sellers;
2. the benefits realised by individual sellers increase as more organisations join the system, i.e. there are network externalities;
3. there may be significant costs for users in switching between competing systems, implying that there will be benefits for developers of the first system launched;
4. electronic markets require large capital investments and provide economies of scale in terms of there being very few costs for additional transactions until capacity constraints are reached;
5. participants may be uncertain as to the actual benefits of joining which may result in individuals delaying entry until they can see the effects on their rivals.

Following the assumption that the formation of electronic market reduces the search costs for buyers, Bakos argued that this would reduce the prices gained by sellers but the effect on search strategies would be complex. The lower search costs would lead to wider searching but this would be counteracted by the greater price consistency leading to less extensive search. For Bakos, the lower costs would be a barrier to sellers collectively setting up the market, with an electronic market more likely to be established by a single seller seeking to gain a strategic advantage or a third-party intermediary. Bakos acknowledged that the existence of net benefits from electronic markets would not necessarily lead to their formation. Bakos (1991) notes that the establishment of electronic markets requires a *‘major fixed investment’* in terms of the systems that are developed and implemented. The costs include installing the necessary hardware and software, and marketing the system to potential buyers and sellers, although he recognised that the growing

provision of standard computer and telecommunications services would reduce the first of these barriers to entry for electronic market developers.

Malone et al. (1987) sought to predict the effect of information technology on industry structure. Their perspective on information technology developed Coase's (1937) and Williamson's (1975) analyses of industrial structure based on transaction costs. They draw upon their dichotomy between markets and hierarchies - Malone et al. redraw Williamson's boundary between the two classes by classifying quasi-firm relationships as being hierarchical, due to the lack of market forces to "*determine price, quantity and schedule.*" One might also argue these relationships do not meet their requirement that there is a management hierarchy co-ordinating the flow of materials.

Malone et al. argued that there would be a growth in *markets* due to information technology reducing the costs of co-ordination across organisational boundaries, with lower co-ordination costs, following Williamson, favouring markets. They found the "*simplicity of this argument quite compelling*". Malone et al. forecast that electronic markets would be more significant than electronic hierarchies in the future of electronic commerce because the lower costs of information transfer, by making the transfer of more complex information cost less, reduces the impact of product complexity, while flexible technologies reduce the asset specificity justifications for hierarchical control. They imply, without justification, that process flexibility is the prime source of asset specificity. This technocentric view of asset specificity overlooks the importance of product specific knowledge and expertise recognised first by Polanyi (1962). Malone et al. further developed their argument that the reduction in transaction costs in electronic markets relative to orthodox markets would lead to the growth of electronic markets by claiming it would also lead to the vertical disintegration of firms: "*electronic markets reduce transaction costs. Where it once made sense to make a product or perform a service in-house, it suddenly makes sense to buy it.*" They conclude "*with such sound underlying economics, electronic markets are not a fad. They are in fact inevitable.*" Malone et al (1987) concluded that "*market participants should consider the potential advantages of providing an electronic market in their marketplace. For some participants, providing such a market may increase the sales of their current products or services. For all participants, it provides a potential source of new revenues from the market making activity itself.*" In a later article Malone et al (1989) identified the provision of electronic markets as an opportunity for third-parties currently not involved in an industrial sector to challenge existing intermediaries by setting up an electronic market which bypassed them.

Interest in the impact of electronic markets on costs, and thereby on industry structure, has increased with the emergence of Internet based electronic markets (Strader & Shaw, 1997; Anderson, 1998), for example

Amazon in book retailing. Gellman (1996) argues that one impact of the lower search costs of electronic markets will be disintermediation: the removal of existing market intermediaries because the Internet will allow firms to deal directly with a dispersed body of buyers without the need for wholesalers and agents. The analyses of Bakos and Gellman are based on a theoretical conceptualising of the economic impacts of electronic markets for buyers and sellers. Bailey and Bakos (1997) addressed Gellman's hypothesis using a series of student case studies of electronic marketing and concluded that electronic markets also created an opportunity for new intermediaries who could provide new services, including matching buyers to sellers and providing information to buyers and sellers. However, the sector in which the use of electronic markets open to a dispersed range of buyers was the trading of agricultural produce as an alternative to the traditional auction market.

### **Electronic Auctions in Agricultural Markets**

Smith (1989) provides an overview of the diversity of agricultural auction markets, identifying the range of idiosyncratic procedures and organisational structures. However Smith notes that they also share common features, whether United States' tobacco auctions, Dutch vegetable auctions, race horse sales or Japanese fish markets. In each case the produce is brought to a defined location at a specified time and inspected by prospective buyers. The auctioneer then seeks the highest price on behalf of the seller. The methods of auctioning vary widely, including English auctions, in which the price rises until only one bidder is left bidding, Dutch auctions, in which the auctioneer progressively lowers the offer price until someone bids, and sealed bid auctions, in which all bidders bid simultaneously and the highest bidder buys the lot.

The agricultural auction market most familiar in Britain is the local livestock auction mart. Every week in market towns across Britain for over a century farmers have brought their stock to the auction market for sale. The stock is inspected by potential buyers, whether other farmers seeking stock for fattening or abattoirs seeking beasts for slaughter, who then bid for the stock. In many markets the market facilities and the actions of the auctioneer have not changed in a hundred years. The auctioneer starts the bidding at a price and then seeks incremental bids, indicated by bidders nodding to the auctioneer, until no higher bid is forthcoming, when the lot is sold to the highest bidder at their bid price. The strength of these markets is the competition between potential buyers but they appear anachronistic and inefficient: they involve large numbers of people spending half a day waiting for their beasts to be sold or the ones they are interested in to be offered for sale, the marts often cover large areas of land in town centre sites which are only in use for half a day per week, and the transport of the stock from farm to mart and then from mart to buyer adds to costs and adversely affects the welfare of the stock. In the smaller markets the small number of buyers in

close contact would lead an observer to question whether there was even a real competitive market in operation.

One alternative to the live market is to use an electronic network to create a virtual market linking dispersed buyers and sellers. Henderson (1984) defined electronic marketing as “*simultaneous trade negotiations among spatially separated buyers and sellers channelled into an interactive central market through electronic communication*”. An electronic market appears to address some of the weaknesses in traditional physical auctions, with the stock staying on the farm until sold and a large number of potential buyers connecting to the auction from their offices. In a British electronic livestock sale the stock for sale is assessed *in situ* on the seller’s farm by a representative of the system operator. Buyers from abattoirs remotely access from their own office an electronic sale catalogue which tells them the number of the stock, their location, a prediction of the grade of carcasses which will result from slaughter and the time at which they will be auctioned on the system. The lots in the catalogue are sold in sequence, simulating the live auction, with bidders using their keyboards to bid, with the system increasing the current price as bids are made. The electronic trading of livestock combines advantages of the physical auction and direct purchasing routes: the transport of animals is restricted to one journey, but there is potentially a greater number of buyers participating in the market. By removing the need for buyers and sellers to travel to the auction, it becomes efficient to establish a wider market, replacing a large number of local physical auctions with a large virtual auction.

The history of existing electronic markets in agricultural produce allows the claims of Gellman (1996), Bakos (1991) and Malone et al. (1987) that electronic markets will have radical impacts in the future across a range of sectors. Within the social analysis of technology and innovation electronic markets are a challenging area for study because of the complexity for developers of building a heterogeneous community of users, including assessors, sellers and buyers. In building the electronic market there are choices which must be reconciled within the community, including its institutional structure, scope of activities, geographical coverage, contractual relationships and technical specification of the system. We should therefore expect electronic markets to be socially shaped by the aims and behaviour of the actors involved.

## **Research Background**

In 1994 as part of wider study into the economic and social impacts of electronic commerce for the European Commission, the author included a study of the first electronic livestock auction system operational in the UK, EASE. From this superficial study of EASE a gap was apparent between the system owner's initial expectations of the system's success in gaining a large proportion of the slaughter livestock sold and the reality of the much lower levels of transactions achieved. There was evidence from this study that institutional resistance by existing auctioneers and abattoirs was inhibiting the use of electronic trading, and that farmers and abattoirs were using the system in ways unforeseen when the system was established.

The research on which this thesis is based sought to map the development of electronic agricultural auctions to uncover the roles of actors, including IT specialists, auctioneers, farmers and abattoir buyers, in shaping both the technology and the wider changes in the supply channel. The EASE system was licensed from Canada, so the scope of this study was broadened to include the development of systems in North America. To assess whether the UK experience was anomalous or one element in a global pattern, the creation of electronic livestock markets in Australia was also covered. The history of electronic fish auctions in Europe was included when it became apparent that the pattern of their formation was significantly different to that seen in the livestock systems.

It was known from previous research that each of the United Kingdom electronic livestock auction systems had failed to meet the expectations of their developers. At a superficial level this can be seen as a failure to build the viable community of sellers and buyers willing to trade using the system. Beyond this tautology it is first hypothesised that in negotiating the form of the technology of the electronic market the negotiation is acting as a surrogate for negotiating the social structure of the market network. Second, it is hypothesised that the diversity of market mechanisms in agricultural produce markets across the world, even between very closely related cultures, for example between Australia and New Zealand, is evidence that markets are shaped by forces more complex than economic efficiency. Third, it is hypothesised that an understanding of the processes shaping electronic markets in agriculture will provide insights into the development of electronic markets in other products.

The research methodology followed was derivative of the Actor Network Theory (ANT) approach of Callon (1986b), focusing on how the instigators built the systems from heterogeneous elements. This methodological approach is discussed in detail and justified in chapter two. The research sought to uncover the social factors shaping the emergence of electronic auction systems at two levels. First, the social, technical and economic pressures shaping the design of the technology, and second the processes by which a network formed linking all the elements required to form a market, both the social (sellers, buyers,

assessors) and the technical (hardware, software, communications and product standards). The systems in use were identified through a literature survey in the Agricola database of the United States Department of Agriculture and a preparatory interview with Chris Smith, at that time a specialist marketing consultant for the Meat and Livestock Commission. Semi-structured interviews were arranged with the individuals responsible for the development of each system. The interview elicited a chronological analysis of their awareness and involvement in the electronic market, with a particular emphasis placed on who they were in contact with and what was the nature of these links. Follow-up interviews were made with buyers, sellers, and individuals involved in technical aspects of the projects. Documents relating to United States and Australian federal government support for electronic markets was located through searches in the archives of the respective government agencies using their respective Freedom of Information legislation. The research included recorded and transcribed interviews with system operators and developers in the United Kingdom, United States of America, Canada, Belgium, Netherlands, Iceland, Australia, South Africa and Holland. The following table lists the interviews upon which this thesis draws.

### Interviews

Name	Position	Organisation	Location	Date
Derek Forrester	Transport Services Manager	Highland Council	Inverness, Highland	19/6/96
Edwin Gillanders	Marketing Manager	Aberdeen & Northern Marts	Inverurie, Grampian	2/11/95
George Forbes	Director	County Auctions	Wooler, Northumberland	3/8/95
Antony Harrison	Director	APEX	Rugby, Warwickshire	8/11/95
Ian Hay	Director	APEX United Kingdom	Old Meldrum, Aberdeenshire	12/12/95

Roger Pearce	Livestock Market Manager	J Stephenson	York, Yorkshire	10/11/95
Stuart Thomson	Director	Thomson, Roddick & Laurie	Dumfries, Dumfries & Galloway	16/11/95
Ian Smethurst	Director	Midland Marts	Banbury, Oxon.	19/1/96
Frank Yeo	Manager	Midland Marts	Banbury, Oxon.	19/1/96
Peter Stoeken	Chairman	British Deer Farmers Association	Penrith, Cumbria	3/7/97
David Jones	Director	Newline Computers	Newton Abbot, Devon	15/7/95
Scott Gardiner	Vice President Marketing	Equity	Baraboo, WI.	27/9/95
Wayne Purcell	Professor	University of Virginia	Blacksburg, Virginia	5/9/96
David Craik	IT Manager	Scottish Milk	Paisley, Strathclyde	6/3/96
Luc Schelfhout	Director	Schelfhout Computers	Stekene, Belgium	13/3/96
Jim Odle	Director	Superior	Denver, United States of America	29/9/95
David Leggat	Market Manager	United Auctions	Perth, Perthshire	30/10/95
Brian Ruthven	Partner	Borders Livestock	Kelso, Roxburghshire	24/11/95

Murray Harvey	Procurement Manager	Scotbeef	Bridge of Allan, Stirling	29/11/95
George Mackay	Manager	Lochinver Fishselling Company	Lochinver	7/7/97
John Shilling	Market Manager	Ijmuiden Fish Market	Ijmuiden, NL	12/3/96
Jim Wideman	Market Manager	Ontario Livestock Exchange	Kitchener, Ontario	26/8/95
Juliet Davies	Buyer	H M Bennet	Andover, Hants	10/7/96
Maurice Colbert	Manager	Irish Co-operative	Dublin, Ireland	20/11/95
Ray Heath	Business Development Manager	AT&T Healthcare	Redditch, Worcs.	8/7/97
Ian Dickson	Manager	AGMEX	Klerksdorp, Republic of South Africa	5/6/97
Ingvar Orn Gudjonsson	Market Manager	RSF	Iceland	12/6/97
John Brickwood	Director	Lysis Computers	Northallerton, Yorkshire	7/3/96
Dick Bruce	Marketing Manager	CALM	Sydney, NSW	20/5/97
Chris Smith	Markets Consultant	Meat & Livestock Commission	Milton Keynes	17/7/95

Mike Jay	General Manager	Milford Haven Fish Auction	Milford Haven	18/4/97
Mike Sobey	Director	APEX UK	Old Meldrum	12/12/95
John Lind	Director	APEX UK	Old Meldrum	12/12/95
Susan Holmes	Project Manager	Vega	Welwyn	9/9/97
Andres Hallgrimson	Manager	ISM	Reykjavik, Iceland	15/9/97
Olafur Thor Johannsson	General Manager	RSF	Njarvik, Iceland	16/9/97
Bryan Renn	United Kingdom Agent	Schelfhout Computer Systems	Eastbourne, Sussex	6/3/96

## Chapter Overview/Synopsis

Chapter two provides a literature review of the social analysis of markets and the literature more directly relating to the benefits and effects of electronic markets. The contrasting approaches to the analysis of technology grouped under the rubric of *social shaping* are discussed and a methodology based upon the relativist actor network theory of Michel Callon is justified as a suitable approach for the analysis of a network information technology.

Chapter three discusses the concept of the *market* and provides a review of the institutional economics and strategic information systems literature which have addressed the concept of electronic markets.

Chapter four describes the history of the development of electronic markets for the trading of livestock in North America, including both computer based selling on description and the competing paradigm of selling using satellite distributed video images.

Chapter five describes the history of the electronic marketing of livestock in Australia.

Chapter six describes the history of electronic livestock markets in the United Kingdom.

Chapter seven describes the history of Continental clock based electronic markets from their roots in the automation of produce auctions in the Netherlands to their widespread use in fish, vegetable and flower markets in Europe. The path by which these auctions developed is contrasted to the livestock auctions described in the preceding three chapters.

Chapter eight reviews the electronic auctions systems studied and adapts Callon's Actor Network Theory to identify how the auctions passed through stages of *conception* when a network was built to draw in the resources to develop the system followed by a more complex *adoption* phase during which a large number of sellers and buyers had to be enrolled into a community trading electronically. A third stage, *dissolution*, is identified in all of the livestock systems during which the social networks degenerate due to a failure to complete the translation of actors during the adoption phase.

Chapter nine draws conclusions from the analysis of electronic markets for the social analysis of network technologies.

## **2. Social Analysis of Network Technology**

### *Chapter 2*

#### **Social Analysis of Network Technology**

## **Introduction**

This chapter explains and justifies the methodological approach taken within the research upon which this thesis is based. Following an overview of the social analysis of technology a methodology derived from Callon's *sociology of translation* (Callon, 1983) is developed.

## **Analysis of the Emergence of Electronic Markets**

The implementation of an electronic market requires the introduction of an IT system linking buyers and sellers. An electronic market is therefore inherently an innovation which requires the formation of both a social and a technological network. Indeed, in building the technological network of computers, telecommunications and software, a vision of the social processes and structures of users may be inextricably embedded and the actions of actors constrained. An electronic market may be viewed as either an institutional innovation or technological innovation. As with other technologies (Mackenzie & Wacjman, 1985, p 3) the *technology* of electronic markets may be restricted to the hardware and software, or widened to include the expertise and routines of users, or wider still to include the institutional structures involved. The aim of the research described in this thesis was to uncover the processes by which these heterogeneous elements combined to form electronic markets. To achieve this the research focuses on the social processes and interactions rather than on the technology itself. In taking this approach the research builds upon a broad range of perspectives which may be grouped under the rubric Social Studies of Technology (SST) (Williams & Edge, 1996).

### *Technological Determinism*

The texts addressing electronic markets cited earlier by Malone et al. (1987), Bakos (1991) and Gellman (1996) each root their analysis in an assessment of the costs and benefits of electronic markets. For Malone et al. (1987) the analysis of electronic markets was straightforward: the capabilities of telecommunications networks and information technology would make electronic markets feasible and their economic benefits would make their emergence "*inevitable*". These analyses do not eschew the social influences on the formation of electronic markets, but do reduce them to an economic level. Grint and Woolgar (1997, p11) claims that espousal of this pure technological determinism is rare, citing Heilbroner (1972) and Toffler (1980). Elements of technological determinism remain in evolutionary economics analyses of technology

(Dosi, 1988; Freeman, 1987) where the determining influence of a universal economic rationality is replaced by the interacting utilities of a constellation of actors interacting through time, referred to earlier in the claim by Malone et al (1987) that electronic markets “are in fact inevitable”, A weaker determinism is seen in analyses of technology which accept that the objectives of technology development are formed socially but the achievement of them is through the determinist application of “scientific” method, as is argued by Vincenti (1994) in an analysis of the history of aeroplane technology. In this Vincenti (1994) claims that the goal of faster air travel was socially shaped but the means to achieve this converged on the most efficient designs to achieve this through variation and selection.

### *Social Studies of Technology*

The rejection of technological determinism has spawned a range of approaches for analysing the social forces influencing technology, including social shaping of technology( MacKenzie & Wacjman, 1985), social construction of technology (Bijker & Pinch, 1984; Pinch & Bijker, 1987) and constructivist studies of technology. Each of these approaches has been influenced by the sociology of scientific knowledge (SSK) (Collins, 1985; Lynch, 1985; Knorr-Cetina, 1981; Knorr-Cetina & Mulkay, 1983) which developed Kuhn’s concept of paradigm (Kuhn, 1962) in empirical studies and historical analyses to argue that scientific *facts* are socially constructed. It has been argued (Woolgar, 1991) that the intellectual interest in SSK was due to it being counter-intuitive to the orthodox position that scientific facts are socially independent representations of the natural world. SSK unmasked the influence of potential use on scientific practice, thereby blurring the distinction between the sociology of science and the social study of technology (Mackenzie, 1991). Woolgar (1991) argues that the reasons for the application of an SSK approach to technology were “*the need for ‘useful’ (‘policy relevant’) social science research*”, citing the emergence of schemes to fund social research into technology, but identifies a lack of reflexive justification by researchers for this broadening of the focus of SSK research and on its implications.

### *Social Shaping*

Mackenzie and Wacjman (1985) proposes that a broad range of writings which rejected crude technological determinism and a focus on the social impacts of autonomous technological change could be grouped together within the term “*social shaping of technology*”<sup>2</sup>. Green (1992) identified three strands in social shaping studies of technology: systems builders (Hughes, 1983), where the focus is on the ordering

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<sup>2</sup> . *The weakness in positing social shaping in opposition to technical determinism of this type is that it is difficult to identify any discourse in technology analysis which follows this determinism, and neither Edge nor MacKenzie and Wacjman cite any examples. Even the most banal management studies literature is predicated on a belief that the managers who read it have a choice, while at the opposite extreme labour process theory accounts of technology accept the potential of those affected by technology to struggle to shape its application.*

of socio-technical elements into complex systems, social constructivists (Williams & Edge, 1996; Pinch & Bijker, 1987; Mackenzie & Wacjman, 1985), where the focus is on applying concepts from the relativist sociology of scientific knowledge to the development of technologies, and actor network approaches (Callon & Law, 1989), where the focus is on the building of the social network to develop the technology. Within each of these strands the social shaping view of technology is based on an analysis of the social groups involved in the process and their power relationships. Edge (1988) sees the task of social shaping research as being the opening of the “black box” of technology to uncover how the technical artefacts are influenced by social pressures<sup>3</sup>. For Edge (1988) a social shaping approach is seen as a rejection of technological determinist accounts of technology in which “*technical change is a prime cause of social change, and that technical changes are **uncaused** - in the sense that they arise only from the working out of an intrinsic, disembodied, impersonal logic, and not from any social influences.*” The use of the term “shaping” instead of “construction” has three significant implications. First, it implies a duality between the “social” and the “technical”, allowing realist studies of technology to be embraced, whereas idealist approaches (for example Grint & Woolgar, 1997) view the technology as being indivisibly embedded within the social. Second, the status of economic analyses in Mackenzie and Wacjman is unclear: whether the *economic* represents an underlying reality or whether the *economic* is socially constructed. Third, it embraces positivist analyses of technology policy: technology becomes something whose impacts that can be consciously “shaped” (Mackenzie & Wacjman, 1985, 3). In refuting technological determinism Mackenzie and Wacjman (1985, p14) states: “*If technological systems are economic enterprises, and if they are involved directly or indirectly in market competition, then technical change is forced on them. If they are to survive at all, much less to prosper, they cannot forever stand still. Technical change is made inevitable and its nature and direction profoundly conditioned by this*”. In this quotation crude technological determinism has been displaced by a slightly less crude economic determinism. Williams and Edge (1996) describes social shaping as being a broad church, embracing industrial sociology, evolutionary economics, economic history and the sociology of science. While united in rejecting technological determinism this conceptual catholicism raises methodological issues, specifically the lack of a position on whether technologies have an essential core and whether the economic analysis of technology is socially constructed or represents some underlying reality.

The status of the economic analysis of technology is significant in the social study of electronic market formation. For example, is the analysis of Bakos (1991) to be treated as an insight into the reality of

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<sup>3</sup> However the opening of the black box uncovers more boxes - social scientists are as much at the mercy of bounded rationality as engineers.

electronic markets or should it be treated as a rhetorical element in the social processes shaping electronic markets? Mackenzie and Wacjman (1985, p15) claims that the economic shaping of technologies includes aspects that “*go beyond and cannot be explained by rational calculation*”, citing Schumpeter (1934; 1939; 1943; 1951) and that “*economic calculation and economic ‘laws’ are specific to particular forms of society, not universal*”, citing Marx (1976 [?], p173-176). Mackenzie and Wacjman (1985) is arguing that “*economic calculation and laws*” are an essential property of economic systems. However, Mackenzie (1990a; 1992) proposes the concept of ethno-accountancy to analyse the local construction of economic analysis. It may be argued from a sociology of knowledge perspective that the claims of economics to represent reality are as open to questioning as are the claims of the natural sciences, but empirical studies of economics practice are rare. In the analysis of a technology, while it is tempting to treat economic analyses as providing insights into the “reality” of a technology, it is less restricting to treat economic accounts as rhetorical influences on the process of their development. In this thesis the arguments of writers proposing economic arguments relating are treated as part of the process shaping the markets rather than objective statements of fact.

In the thirteen years since 1985 the success of the concept of the social shaping of technology is seen in the number of academic papers using it in their titles and its use as synonymous with the social analysis of technology, for example in the research objectives of the European Commission’s Targeted Social and Economic Research (TSER) programme and as a theme for the multidisciplinary research network COST A4. This inclusivity, which has encompassed constructionists, positivists and economists, enables social shaping to form a basis for multidisciplinary networks, but it also leads to it encompassing contradictory positions and prevents it forming a methodological foundation for the social study of a technology. However, within the broad church of social shaping can be found narrower approaches which focus on the social processes of technology development.

### ***Social Construction of Technology***

Social construction of technology (SCOT) (Bijker & Pinch, 1984) is a narrower approach to the analysis of technology than social shaping which rejects the linear model of technological development, realising that alternative solutions may each be seen to “work”, termed *interpretive flexibility*. SCOT accounts of new technologies examine how the competing alternative technical solutions become closed off and the final form of the technology becomes stable, for example bicycles (Bijker & Pinch, 1984; Pinch & Bijker, 1987; Bijker, 1992; Bijker, 1995). Key to the SCOT analysis of technology is the study of conflict or competition within the development of new technologies, in which decisions are taken between alternative objectives by developers or between competing solutions. Pinch and Bijker noted that eventually the

debate is concluded and closure is achieved, with one solution becoming dominant. This emphasis on the reconciling of debates or conflicting approaches may be traced to the roots of SCOT in analyses of the sociology of science in general and Kuhn's (1962) concept of paradigms in particular. In these studies the focus is on competing designs ("interpretative flexibility"), the social construction of the design amongst social groups ("relevant social groups") and the process by which one design becomes dominant ("closure"). SCOT develops the SSK focus on competing knowledge claims with an evolutionary approach, "*alternation, variation and selection*" (Bijker & Pinch, 1983, p28), providing a link to positivist evolutionary economic analyses of technology development (Arthur, 1988; David, 1993). The SCOT approach transfers the relativist SSK analysis of competing theories to competitions between designs, but while retaining the relativist treatment of claims about the technologies the technologies themselves are treated realistically. That closure in technological debates is rhetorical is significant because it implies that closure can never be final and closure may occur around different solutions in different communities.

Winner (1993) criticised the SCOT approach of Pinch & Bijker for overlooking the consequences of technologies. While this argument is itself open to the criticism that effects are essentially embedded in technologies (Woolgar, 1997), Winner argues that this bias is due to the SSK roots of SST leading to the articulation of a narrative describing the activities of the designers of the technology at the expense of those affected by its use. For Winner, the SCOT concept of "*relevant social groups*" is problematic because of the difficulties in specifying how the researchers are able to identify these groups and, by exception, exclude the "irrelevant social groups".

While SCOT is relativist in its approach to technological expertise it is realist in its approach to the technology itself. In SCOT, while knowledge about objectives and capability is treated as being socially constructed, the technological capabilities of the artefact are taken as being known. This realism implies a closure imposed by the observer at the time when the technological artefact passes from being a construction into reality, albeit with a constructed, unclosed debate between alternative realities. Confusingly, therefore, in the Social Construction of Technology the technology itself is not a construction, leading Grint and Woolgar (1997, p19) to describe it as "*the so-called social construction of technology*".

### ***Relativism and Realism***

The treatment of economic analyses as realist has already been rejected in this thesis, but the ambiguous division between the real and the constructed in SCOT raises a fundamental question faced in any social

analysis of technology: where is the boundary between reality and the interpretations of observers. Williams and Edge (1996) identifies these issues of relativism and realism, and by implication the meaning of “*constructionism*”, as significant points of divergence within social shaping analyses of technology. Willims and Edge (1996) states that at the core of social shaping “*the behaviour and properties of technologies are always mediated through particular social settings*”, allowing social shaping accounts accounts of technologies which are realist not only in their description of what the technology is but also treat realistically the economic rationale used to select it. Diverging from this realism is the methodological relativism, described by Collins and Yearley, (1992) and exemplified by Mackenzie (1990b) and Vincenti (1994), in which the technology is treated as real but the criteria influencing its selection are treated as being socially constructed. Beyond this, as the belief in the accessibility of reality to the researcher diminishes, lie epistemological relativism (Barnes, 1974 ) and social realism (Collins and Yearley, 1992), in which the researcher can only gain a hold on the socially constructed realities of social actors, and ontological relativism in which it is assumed that the world accessible to the observer is wholly constituted through discourse (Grint & Woolgar, 1997). The fundamentalist anti-essentialism of ontological relativism is beyond constructionism because, despite the claim in Williams & Edge (1986), this implies that there is no accessible natural world to construct from.

In SSK the use of symmetry (Bloor, 1976) and empirical relativism (Collins, 1985) led to accounts of scientific practice in which the competing claims of researchers were treated equally, it not being the role of social scientists to adjudicate on the epistemological status of “facts”. This differed from the pre-Kuhnian sociology of science (Mannheim, 1936; Merton, 1942) which addressed the creation of “false” claims and the social practice of science. Woolgar and Ashmore (1988) posits an evolution of the sociology of scientific knowledge from a pre-Kuhnian perspective in which both the treatment of science and the social were realist, through post-Kuhnian SSK in which the science is relativised and on to a third reflexive stage in which the social is also treated relativistically. In post-Kuhnian SSK, for example Latour & Woolgar (1979), this dichotomy between socially constructed facts and social realism leaves the ontological status of the laboratory apparatus unclear, but when the approach is addressing the construction of facts this ambiguity in the status of apparatus is unproblematic. In the application of an SSK approach to technology this ambiguity becomes more significant: is the technological artefact treated realistically and are actors’ accounts of what the technology can do treated realistically?

In pragmatic accounts of technologies the realistic treatment of technological artefacts is implied (MacKenzie, 1990b), but this leads to them accepting as true claims about the technology which could in principle be contested and arbitrating in disputes to identify the “true” account. On the other hand treating

technology relativistically as a social construction and eschewing any essentialist claims about what is the technology undermines the practical utility of social studies of technology and the validity of ethnographic research. For example, it would be a contradiction in a study of transport technology to treat relativistically claims about the existence of buses while accepting as factual an interviewee's claim to be a bus driver: relativistically one would have to describe them as someone who claimed to be or was recognised as a bus driver. As a basis for a research programme relativism has the disadvantages that it undermines the ability of the researcher to identify causal relationships, because causation implies realism, and from this a difficulty in reaching policy recommendations. Within critical social theory relativism has been criticised because it removes the potential for the espousal of social change and "*showing that a particular piece of scientific knowledge is poor*" (Sismondo, 1993, p3), especially in feminist analyses of technology (Sismondo, 1993).

Woolgar (1997) argues for an anti-essentialist constructivist approach to the analysis of technology, interpreting knowledge of technological artefacts as being socially constructed in the same way that scientific knowledge is socially constructed. Woolgar (1997) claims that the concept of technology being socially constructed is less radical than scientific knowledge being socially constructed because technological knowledge generally has a weaker claim to objective truth than scientific knowledge. Sismondo (1993) traces social construction to Berger and Luckman(1967), but Velody & Williams (1998) identifies the infrequency with which the phenomenological approach of Berger & Luckman is drawn on in recent social constructivist analyses, claiming that Kuhn(1962) and Foucault (1977) have been more influential. Berger and Luckman addresses the social construction of everyday reality, building on the American sociology of knowledge tradition (Mead, 1938) which differentiated between scientific knowledge and prosaic knowledge. While Berger and Luckman's approach does not readily address the creation of scientific knowledge in laboratories it can be argued that it is more relevant when considering the tacit knowledge required by users of mass technology. The roots of social studies of technology in SSK therefore creates the danger that it may over-emphasise the activities of technologists and under-emphasise the roles of users in the development and use of the technology.

However, whether approaching from the epistemological angle of SSK or from a phenomenological perspective, the concepts used to describe a technology may be treated as constructs (Gergen, 1998), maintaining a sceptical attitude to their truth. Within the social studies of science and technology the term "social construction" covers a range of analytical perspectives. Sismondo (1993) claims that social construction may be interpreted as construction of institutions from social actors, the construction of

theories from data and observations, the physical construction of artefacts and neo-Kantian construction of reality. Sismondo (1993) is unclear which strand of neo-Kantianism it is labelling anti-essentialist social constructionism: the social constructionism described may be considered neo-Kantian in its repudiation of positivism and epistemological basis. Hacking (1998) notes that the term constructionism is used in social science discourse to apply to any social “*entities, states or conditions*”, which it argues should be limited to entities which have been constructed from other entities, retaining its metaphorical meaning. Hacking also argues that the word “social” should be dropped except where its omission would lead to ambiguity or it is used for emphasis. When applied to technology it is difficult to imagine how a technology could be constructed other than socially, a point which was recognised in Latour & Woolgar (1986), renamed *Laboratory Life: The Construction of Scientific Knowledge*, losing the “social” from the first edition’s title.

Behind the disputes about the meaning of “constructionism” lies the more fundamental issue in social studies of technology: whether social science observers can make definitive statements about the technology. On the one hand, adopting the perspective of a naïve Martian, any statement about a technology may be questioned and the motivation of the author queried, but in maintaining this scepticism and taking the “true” effects and functions of the technology as being beyond the cognisance of the observer, the basis of the social study of technology is challenged because SST implies that there is something technological beyond the purely social.

The rejection of material and social realism led to the analytic position that the researcher studying science practice could adopt a position of semiotic idealism, analysing how “facts” are formed through rhetoric and its interpretation (Potter & Weatherell, 1987). Notable in the sociology of science from this perspective is Mulkay, Potter & Yearley (1983), Gilbert & Mulkay (1984) and Mulkay (1985) which applied the discourse analysis of Derrida (1978) to scientific research. Latour and Woolgar (1979) also rejected material realism and adopted an ambivalent attitude to social realism, analysing how “inscription devices”, including the artefacts of laboratory experiments, communicated knowledge and concepts. Grint and Woolgar (1997, 32-38) extended this approach to the analysis of technology, arguing against the view expressed by Winner (1985) and Kling (1991) which focused on the effects of technology. Grint and Woolgar (1997) argues for a fundamentalist anti-essentialism, in which all the interpretations of technology are socially formed. Where Kling and Winner argue that technologies have effects built into them, Grint and Woolgar (1997) claims that technology should be considered semiotically as text, claiming: “*Hence, what a machine is, what it will do, what its effects will be, are the upshot of specific readings of*

*the text rather than arising directly from the essence of an unmediated or self-explanatory technology. A technology's capacity and capability is never transparently obvious and necessarily requires some form of interpretation; technology does not speak for itself but has to be spoken for*<sup>4</sup>". Anti-essentialism has been most significant in gender studies and social psychology where the division between inherent characteristics and socially conditioned ones has been central<sup>5</sup>. Grint and Woolgar(1997, 153-164) responds at length to the claim in Kling (1992) that at their heart technologies have fixed effects. Grint and Woolgar addresses Russian roulette, following up Kling's claim that guns are a technology with obvious effects independent of their interpretation. Grint and Woolgar claims that Russian roulette represents a case where "*one's theoretical perspective is least likely to apply*". It argues that "Russian roulette is an inescapably social and cultural event, and not something **simply** determined by the technology<sup>6</sup>". At length it then considers how aspects of the game, including the death of a participants, are interpreted by the observer. However, to justify the above quote they refer to the Collins dictionary to identify "*six distinct aspects of to this procedure*". The third rule is "*Only a revolver is permissible*", which is an essentialist statement: Russian roulette requires something which is a revolver. They could go a step further and cite the Collins dictionary definition of revolver<sup>7</sup>, but this would breach the claimed anti-essentialism. To eschew this linguistic essentialism would leave Grint & Woolgar speechless. To be a revolver the object in the room must include the essence of revolver. While it claims that this is a "hard case", the inherently social ritual of Russian roulette and the complexity of defining the essence of revolver make this a relatively easy case for anti-essentialist unmasking. The more difficult cases for Grint and Woolgar's anti-essentialism are where the characteristic is not socially mediated. For example, Grint and Woolgar criticise the claim in Winner (1985) that the design of bridges in New York were designed by Moses to prevent poor people and blacks using them by making them unsuitable for buses as being an interpretation of the technology rather than essential to it. However, a more difficult challenge would be to view a claim that the Channel Tunnel links England to France as being a social interpretation. One could argue ontologically that the Channel Tunnel does not exist, but if it is claimed to exist one could not claim epistemologically that it links two other countries because if, for example, it linked Italy to Switzerland it would not be the Channel tunnel. For these reasons a more difficult case than Russian roulette to argue that "*a technology's capacity and capability is never transparently obvious*" is plate glass.

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<sup>4</sup> In this case nothing "speaks for itself"

<sup>5</sup> In gender studies this corresponds to distinction between sex and gender - in discourse on technology there is no linguistic distinction between essences and interpretations, allowing idealist accounts to be read realistically and vice versa.

<sup>6</sup> Emphasis added

<sup>7</sup> "Revolver: a pistol having a revolving multichambered cylinder that allows several shots to be fired without reloading" (Collins English Dictionary, 1994).

More usefully Grint and Woolgar argues that technology may be read as text, where designers 'write' the technology and users 'read', allowing scope for the nature and capabilities of the technology to be interpretatively flexible to the observer. Grint and Woolgar backs off from the radical implications of technology as text, claiming their approach is "the exploration of a metaphor". Why they can only view this as metaphorical is not explained, but it may again be due to residual technicism and essentialism. What are the differences between a text and a technical artefact? One is that a text does not make any claim for its capabilities in itself whereas a technical artefact is read to not only claim its potential but also carries it out. From an anti-essentialist position this is not a problem: one goes shopping and buy a Jeffrey Archer novel and a kettle. One is interpreted as being a source of entertainment and the other of boiling water. After reading the book and using the kettle the shopper is dissatisfied because the book was not entertaining and the kettle did not boil water. For the shopper these are both sensed as facts, but for the relativist observer they are both interpretations. For the observer viewing 'technology as text' as a metaphor there is a danger that the non-functioning kettle will be seen as more true because she has seen it not operate rather than have the shopper's account that the book was not interesting, but this is granting realist status to the kettle but not the book. The Grint and Woolgar account (Grint & Woolgar, 1997, pp 71 - 94) of applying the concept of "technology as text" addresses an ethnographic study of usability trials for a microcomputer. The designers sought to construct the user but this construction was affected by the interpretations made by trial users during usability trials. Grint and Woolgar is therefore looking at the reflexive relationship between writing and reading the technology and the social context in which these interpretations were made. The coverage of both reading and writing technology leads to the view that texts, including technical artefacts "act at a distance" (Law, 1986<sup>8</sup>), but this opens up the dangers of imputing the intentions of the designers (Winner, 1985). Alternatively technology may be seen as being autonomous of its author, with the users interpretation of the author shaped by the technology and associated texts<sup>9</sup>.

Anti-realist studies of technology are criticised by Sismondo (1996, p116) for not allowing the achievement of technical success to be accounted for and the difficulty in practice of reducing a decision to

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<sup>8</sup> "The text is the secret weapon of science" Law, 1986.

<sup>9</sup> The difficulty of identifying the purely technological at the heart of the development of information technology was unmasked by Rachel & Woolgar (1995) in an ethnographic participant observation study. This claims that the objective of the study was to identify the technical at the core of the project, but this was not found. Starting from a position of attempting to refute the anti-essentialism of Woolgar (1988), Rachel & Woolgar concludes in agreement with Woolgar .

purely sociological factors.<sup>10</sup> Sismondo (1996, p 122) also identifies a creeping realism in the ostensible relativism of Latour (1988), for the reader of Latour is led to see social actors as real. Callon & Latour (1992) in a response to Collins and Yearley (1992) accept this, claiming that it is realists and constructivists who adopt extreme positions and that entities (i.e. actants) are “*a combination of these two pure repertoires*”.

### ***Institutional Structure***

The emphases on closure in technological debates and implementation in the social study of technology has led to the institutional structure within which technologies are developed being relatively neglected (Green, 1992). Green (1992) criticised Bijker, Pinch and Hughes for not putting technological developments in the context of “*one of the most significant organisational innovations of the last 100 years: the firm,*” proceeding to claim that “*whatever the influences on innovation, whatever the nature of the actor networks, the central institutions through which new technologies ‘emerge’ are firms.*” However, it may be argued that Green overlooks that technology is not just the development of marketable products and that, while most people hierarchically work in firms and most resources used in technological development are owned by firms, firms are essentially arbitrary social networks grouped around collective ownership of property rights. Conventional linear accounts of technological change neglected the importance of a social network involved in the development of new technologies (Hughes, 1983). Hughes (1983) used a social network approach to describe the development of electricity generation and transmission. When studying the emergence of network technologies, a focus at the level of interactions of firms may neglect the relationships crossing firm boundaries (Berkowitz, 1988). Berkowitz (1988) argued that with complex inter-organisational relationships, the orthodox view of the firm as the locus of decision making neglected the importance of intra-organisational and inter-organisational structure. Indeed, it can be seen as being a weakness in many accounts that they reify and anthropomorphise the firm, seeing it as a conscious social actor. However, Hughes (1983) and Berkowitz (1988) both view the social structures crossing firm boundaries as objectively accessible to observers, whereas a relativist perspective would view the self-attribution of social actors to firms as a construction. The development of electronic markets crosses organisational boundaries, but to follow a sceptical, relativist approach requires that identification with an organisation is contestable rather than taken as an incontrovertible aspect of the context of the technology’s development. For this reason, a valid social network methodology must be reducible to the level of individual social actors.

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<sup>10</sup> Sismondo claims Mackenzie history of statistics gives functionalist explanations for people’s actions and beliefs: “Arguing that they are ‘appropriate’ for these people’s positions”.

## *Actor Network Theory*

The relativist network approach for analysing innovation which has been most widely described is Actor Network Theory (ANT) proposed by Callon and associates in a range of studies, including analyses of electric vehicles (Callon, 1986a), aquaculture (Callon, 1986b) and aerospace (Law & Callon, 1992). The application of ANT seeks to understand the process by which a network is constructed by enrolling social and material elements. To provide a theoretical model of how actors are drawn into the network developing a new technology Callon developed the concept of *translation* (Callon & Law, 1982). Callon was extending to technology the methodology developed by Latour and Woolgar (1979) in studies of laboratories. In his study of marine scientists developing methods of scallop fishing at St Brieuc, Brittany, Callon (1986a) identified four *moments of translation* by which the scientists built the network.

1. *problematization*: making themselves the solution to a problem significant to other actors
2. *interessement*: lock the other actors into their roles
3. *enrolment*: strategies to define and inter-relate the other roles
4. *mobilisation*: methods to ensure that supposed representatives of collective interests were able to adequately represent them.

Callon's analysis explicitly treats social and natural elements symmetrically, but focuses on the central role of the scientists in making themselves significant and shaping the roles of the other actors. Callon (1986) approach followed the anti-realist idealism of Woolgar going beyond constructionism: "*Once an actor world comes into being it does not draw its entities from previously established stock. It is not constituted in the way that a shopping cart is filled. In short there is no world or worlds from which pre-existing elements can be extracted*". However, in the description of the building of the actor world in electronic vehicles, one of the actor-networks translated was Renault, a manufacturing organisation. It is hard to justify that the developers had no awareness of Renault prior to the translation as in that case it would be hard to imagine the unexplained process that brought them together. Williams and Edge (1996) criticised Callon for overlooking the influence of pre-existing knowledge and social relationships. However, Callon's approach is consistent with epistemological relativism: Renault was a construction to the engineers prior to its *enrolment* and in the process of its translation it became something else to the engineers.

Callon's sociology of translation analysed how social actors enrolled the resources for their projects, building a network of social and technical entities. Callon (1987) further developed this approach to

network building as Actor Network Theory (ANT). Callon's Actor Networks are heterogeneous associations of actors, which include individuals, institutions and technological components. The first stage in their organisation is simplification, in which actors limit the near infinite possible relations to a series of discrete relations with entities whose roles are well defined, which may themselves take the role of representing more complex networks. Within actor networks the relationships between entities are being transformed. It may be the artefact itself which is being transformed, but also it may be the expectations of users or the role of actors which are transformed. The developers of complex technological systems are combining a technical/scientific analysis of the artefact's functionality with a sociological analysis of how the resources are deployed in its formation and how it will interact with users. In this approach the formation of the technology and the social network in which it forms are seamlessly interwoven and co-evolving. Callon claims there are two "mechanisms" by which actors redefine the other elements in their network: simplification and juxtaposition. Callon (1987) claims that "*Reality is infinite. In practice actors limit their associations to a series of discrete entities whose attributes or characteristics are well defined.*" Juxtaposition is the relating of elements to other elements. For Callon (1987) juxtaposition and simplification are intertwined : "*the simplifications are only possible if elements are juxtaposed in a network of relations, but the juxtaposition of elements conversely requires that they be simplified.*"

Callon's Actor Network approach as described in Callon (1986; 1987), while using a network metaphor, is not explicitly a network methodology: the studies focus on how a core group of scientists or engineers build the network of elements. Callon's approach evolved into a network approach and Graham (1998) claims that the relativism of Callon (1986) is contradictory to a social network methodology which reduces the relationships observed to a single network because the researcher cannot infer that the linkages described by each individual are equivalent without the creeping realism of recourse to the "*world or worlds from which pre-existing elements can be extracted*" which Callon(1986) rejects.

### ***Techno-Economic Networks (TEN)***

While the symmetry of Callon (1986) led to both social and technical entities being treated idealistically, by Callon (1991) and Law and Callon (1992) this has changed into both social and technical being treated realistically. Callon (1991) goes beyond the nodal networks of ANT, in which the links from a central actor are analysed, proposing Techno-Economic Networks (TEN)<sup>11</sup>, in which an extended network of heterogeneous entities is analysed.

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<sup>11</sup>*Techno-economic networks* is defined by Callon as "a term which I will use to describe a co-ordinated set of heterogeneous actors which interact more or less successfully to develop, produce, distribute and diffuse methods for generating goods and services".

Callon (1991) splits the network into two levels. First, there is a *global network* which is built and stabilised by the actors to provide the resources to build the project, which creates a “negotiation space” (a space, period of time and resources which enables the project to be built). Second, a local network is created to “do” the project. The explicit analysis of a global network avoids the methodological problem of separating factors into the “content” of the project and its external “context”, allowing heterogeneous elements from inside and outside the project to be juxtaposed. Callon (1991) is influenced by concepts from systems theory and economics: “black boxes”, irreversibility and path dependency.<sup>12</sup> Callon and Law (1989) returned to the case of the St Brieuc scallops to demonstrate how the actors translated heterogeneous entities into elements in their network and then placed these elements into the overlapping *sociotechnical network*. Callon and Law (1989) argues that the separation of translated entities between the content of the project and the context in which the project existed was achieved by the actors during the creation of a negotiation space with the context stabilised .

Callon (1993) further splits the social networks involved in the development of technologies into *conception* networks, in which actors seek convergence (or closure) of the technology and *adoption* networks in which users are enrolled. These phases may overlap, with the first adopters being involved in the conception stage. Callon argues that as networks evolve, the members within the networks become more similar to each other, and therefore more distinct from the population outside the network. Callon (1993) aims to “*unify evolutionary analyses, whether sociological or economic*”<sup>13</sup>. This extension to develop a unifying theory of innovation suffers from ambiguity about the epistemological status of entities in the network. Law and Callon (1992) claims that the approach adopted to analyse the “failure” of the UK’s TSR aircraft programme describes the project in a way “*that is more than ‘simple’ history*”. While they claim to follow Latour’s injunction to “follow the actors” the methodology for collecting the data is vague and appears largely dependent on secondary sources writing descriptive accounts. The narrative is littered with anthropomorphizing the commercial firms and government departments involved, for example “*So far as the Treasury was concerned, it was important that the end product be cheap*”. Using ANT this could be treated as “the project managers viewed the Treasury as an actor network simplified to an actor network which was believed to want the project to be cheap”. While the former is stylistically preferable it

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<sup>12</sup> When a network is “strongly convergent and irreversibilised it can be assimilated to a black box whose behaviour is known and predicted independently of its context” - this is a dangerous reductionism, surely its convergence (i.e. closure) is an interpretation.

<sup>13</sup> Callon 1993 uses irreversibility in technical sense but allows degrees of irreversibility.

leaves it ambiguous about whether the simplification of the Treasury was by other actors or by the authors and also allows the account to be read as a banal factual account.

The later writings of Callon are also ambiguous on the status of the economic. Callon (1991) treats money as an intermediary which passes between actors, sliding towards an essentialist conception of value. Callon (1991) claims that the irreversibilisation of a network can be mathematised *“since each element is quantitatively linked, by its specifications, to other elements. For example, it is possible to link the performance of a technical object (the speed, memory and power of a microprocessor), the type of user, and the price that they are willing to pay”*. While this irreversibility is not the irrevocable irreversibility of economics and systems theory<sup>14</sup>, it implies that closure may be due to essential technological factors rather than a rhetorical accomplishment. Callon (1993) takes this positivism a stage further, proposing the use of Markovian simulations to analyse innovation.

Collins and Yearley (1992a, p321) criticises the symmetry in ANT, which views the social and non-social actors in the networks equally, including the scallops and technical hardware, as “sociologically prosaic”. Callon and Latour (1992, 352-353) responded to Collins and Yearley’s insistence that Callon’s scallop study should have focused on how scallops were constructed by the scientists. *“To pretend that to document the ways scientists bring in non-humans, we sociologists should choose ... that scallops do not interfere at all in the debate among scientists striving to make scallops interfere in their debates - is not only counter-intuitive but empirically stifling. It is indeed this absurd position that has made the whole field of SSK look ridiculous and lend itself to the ‘mere social’ interpretation. The only viable position is for the analyst not to take any ontological position - especially social constructivism - and to observe how the importation of various scallop like entities modifies the controversy”* (Callon and Latour, 1992, pp 352-353). While the theoretical debate triggered by this position has been entertaining (Callon & Latour, 1992, Collins & Yearley, 1992b), the methodological assumption of this symmetry and the rejection of any essentialist assumptions by researchers about the true nature of the technology or actors has limited the use of ANT/TEN as methodological tools for studying innovation. However, the strength of Callon’s network approach to innovation compared to more orthodox social network approaches (Molina, 1989), is to view technology and the network as indivisible, rather than viewing the technology as the product of the network.

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<sup>14</sup> *“All translations, however apparently secure, are in principle reversible”* Callon (1991, p 150)

## A Social Network Methodology

The study on which this thesis is based followed Callon's methodological prescription "*follow the actors*" (Callon, 1986b; Latour, 1987), tracing how auctioneers, technologists, farmers, abattoir buyers and livestock were involved in constructing the networks, but often failed to stabilise them. Again following Callon, the focus of the studies was on the instigators of the electronic market systems, seeking to identify how they enrolled the resources and actors for the projects, from conception through to adoption. However, unlike the majority of published ANT cases the fieldwork was of necessity not an ethnography of the development of the systems as they happened, rather interviewees were interviewed to uncover their narratives about the history of the systems and their current perceptions. To provide an insight into the historical processes of *translation* and *enrolment* greater weight was given to contemporaneous literature, both internal documentation and published materials to support the elicited narratives of actors.

A social science analysis of technological innovation, especially when addressing the history of a technology, must take account of contemporaneous literature describing the technology<sup>15</sup>. However, this interest in literature has two aspects. First, as documentary evidence about what happened, and second, as an element of the process which was used to enrol actors and translate actors into the network. The first of these treats the technology realistically, albeit whilst possibly maintaining scepticism about whether the account is true, while the second is relativist, focusing on how texts use rhetoric to influence readers. Adopting the first of these perspectives enables the resulting distillation to claim to be a definitive account, whereas adopting the second approach the text is written with awareness that it too may be analysed rhetorically and its purpose queried<sup>16</sup>. While a rhetorical reading of texts allows the use of texts in the process of translation to be unmasked, this leads to all statements being qualified and an awareness in the text being written of its own use of rhetoric. These issues of reflexivity in sociology of scientific knowledge are developed in detail in Ashmore (1989). Latour (1988, p168) argues against a regression of self-awareness in sociological texts: "*meta-reflexivity is based on the idea that the most deleterious effect of a text is to be naively believed by a reader as in some way relating to a referent out there. Reflexivity is supposed to counteract this effect by making the text unfit for normal consumption*". Latour (1988, p170) argues for *infra-reflexivity*: "*If meta-reflexivity is marked by an inflation of methods, infra-reflexivity is characterised by their deflation. Instead of piling layer upon layer of self-consciousness to no avail, why*

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<sup>15</sup> Basing their own texts on ethnographic studies, the analysis of texts in the process of translation is neglected. The one case based on historical sources (Law & Callon, 1992), does not address the status of the accounts on which the analysis is based.

<sup>16</sup> Obviously accounts which claim to be realistic can also be read rhetorically

*not have just one layer, the story, and obtain the necessary amount of reflexivity from somewhere else?"* In practice infra-reflexivity treats the description as naïve realistic narrative, postponing the addressing of reflexivity to the analysis. Mackenzie (1990b) or Spinardi (1994) are exemplary infra-reflexive descriptions of defence technology, allowing them to be read either as definitive realist accounts or as an unmasking of social processes. In this thesis the descriptions of electronic market systems in chapters four, five, six and seven are written infra-reflexively, with reflexivity addressed in chapter eight.

The status of texts in the social analysis of technology raises methodological issues relating to the relative status of interview transcripts and contemporaneous texts. From a realist perspective interview transcripts may be seen as being more immediate and more reliable than text sources, the former representing the testimony of witnesses whereas the latter are hearsay. However, in unmasking the process of translation the texts used at the time to enrol and translate may be more valuable than witness recollections, with the dangers of selective recollection and post-hoc rationalisation. The conventional privileging of information elicited by the researcher over text sources, as implied in the distinction between *primary* and *secondary* sources, may therefore be reversed<sup>17</sup>. For this reason, in the descriptions of the development of electronic markets in chapters four, five, six and seven, where information was duplicated between interviewees and text sources, the text sources are cited. Where there was disagreement between interview and published accounts, these conflicts are noted.

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<sup>17</sup> Published text sources also have the advantage of being corroborated by sceptical readers and are not hindered by issues of confidentiality.

### **3. The Context for the Emergence of Electronic Markets**

#### *Chapter 2*

#### The Context for the Emergence of Electronic Markets

*“The agricultural class is the least of all disposed to innovation, and the most peculiarly attached to ancient customs and routine” J. R. McCulloch*

## **Introduction**

This chapter provides an overview of the historical, social and historical contexts in which electronic markets for agricultural products and fish have emerged. An overview is provided of the evolution of agricultural markets in the United Kingdom, through seasonal fairs, local markets, the introduction of auctioning and the growth of direct selling between producers and processors. The roles of markets are considered, including the dissemination of price information, the distribution of produce and the taxing of trade, and the diversity of methods and structures seen within markets around the world is discussed.

Trade in agricultural produce is not a clean slate on which the electronic market can be overlaid. As cited in the preceding chapter, the analyses of observers draw on conceptions of the functions of markets and the existing actors will influence the building of the electronic market. This chapter first provides an overview of three competing conceptions markets: the market as anonymous forum, the market as social institution and the market as social network. The chapter then provides a brief overview of the evolution of livestock markets. Finally, it is argued that the conjunction of the historical decline of live markets, the economic analysis of this decline and the technological feasibility of electronic markets created a climate favourable to the development of electronic agricultural produce markets.

## **Conceptualisation of Markets**

### *Markets as Anonymous Fora*

The concept of the market has been central in classical and neo-classical economics since Adam Smith (1776), but economics theory has largely neglected the structure of markets. Early discussions of markets viewed them as abstract locations in which exchange took place between anonymous buyers and sellers (Smith, 1776; Ricardo, 1817). This perspective has remained a significant strand in mainstream economics up to the present (Friedman, 1962). Indeed, from Smith to Friedman any social linkage between buyers and sellers in a market is seen as a distortion and potential source of inefficiency. While Adam Smith (1776) argued that the wider a market the greater its efficiency, he did not address in detail the structure of markets, except to argue that the existence of close interpersonal ties in trade relations was a source of anti-competitive behaviour<sup>18</sup>. Despite Smith's lead in seeing the structure of markets as a factor affecting their efficiency, the canon of economic writers, including Ricardo, Mill, Keynes and Friedman, eschewed

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<sup>18</sup> Smith (1976,[1776], p 144) "*People of the same trade seldom meet together, even for merriement and diversion, but the conversation is a conspiracy against the public, or in some contrivance to raise prices*"

discussion of the social factors influencing markets. In this approach the “*perfect market*” was one in which “*the stronger is the tendency for the same price to be paid for the same thing at the same time in all parts of the market*” (Marshall, 1890). However, in his later writings Marshall increasingly recognised the significance of social relationships in the market, identifying the significance of informal regulation and familiarity between buyer and seller (Marshall, 1919). Marx (1867, p195), while still being caught in production cost approaches to value, also recognised that the market, whether for commodities or for labour, was a network of social relationships and that the forms of markets were shaped by their history.

The dominant concept in neo-classical analysis of markets was the ideal of perfect competition. Perfect competition in markets is defined by Bannock et al. (1987) as “*a model of industrial structure in which many small firms compete in the supply of a single product*”. The primary features of perfect competition are: a multitude of buyers and sellers, firms act to maximise profit, firms may costlessly enter and exit the market, and the outputs traded are homogenous. The trading of agricultural commodities appears to meet the first and fourth of these conditions, if not the third. Robinson (1934) recognised the practical difficulty of achieving the perfection of perfect competition, noting that “*competition can only be perfect, given rising marginal costs, if the number of firms is infinite. Absolute perfection of competition is therefore impossible.*”

In the nineteen fifties there was a surge of interest in the concept of the market from economic sociologists, largely attempting to follow Marx in developing a social theory of markets linking economics to sociology (Polanyi, 1945; Parsons and Smelser, 1956). Parsons and Smelser (1956) recognised that the economic analysis which categorised markets on a continuum between perfect and imperfect, depending on their transparency and theoretical efficiency, was inadequate to understand the variety of social processes in markets, arguing that a market for consumer goods is qualitatively different to a labour market because each market is linked into different social sectors. Robinson (1979), in summarising the history of the development of markets, placed the market within the wider context of economic theory and implied that markets were social institutions shaped by their history. From an institutional economics perspective, Coase (1988, p7), accepting the importance of markets as the most significant interface between organisations, identified the lacunae surrounding the study of markets in economic theory: “*Although economists claim to study the market, in modern economic theory the market has a more shadowy form than the firm... .. discussion of the market itself has entirely disappeared.*” From an economic history perspective the same void was identified by North (1977, p 710). For North, developing the approach of Polanyi, the continuing existence of diverse market structures acted as a refutation of the crude economic determinism that most economic analyses were based on, in which economically efficient institutional structures would necessarily replace less efficient structures.

### *Markets as Social Institutions*

White (1981), approaching the analysis of markets from a sociological perspective, recognised that markets are social structures built through the interacting perceptions and decisions of actors. He believed that it is still possible to analyse markets by treating individuals as archetypes. White viewed that the roles taken by actors within markets is influenced, and therefore shaped, by the behaviour of others and their inter-relationships. From an economics perspective Hayek (1976, p108) recognised that rather than the idealised view of a market as a single location in which buyers and sellers meet, a market was a “*network of interlaced economies*”, while from a sociological perspective Podolny (1992) also adopted a network approach to the analysis of markets, identifying the importance of status in interpersonal links. A network model of markets was refined by Baker (1984; 1990) in studies of financial markets. Baker developed a structural view of markets, seeking to identify the network of traders in markets and the effects that the network structure had on market behaviour. Baker realised that markets are socially constructed and that the specific links between entities in the market were significant, identifying close, isolated markets and more open wider networks. While the neo-classical view of markets was based on the anonymous interaction of autonomous entities, Baker (1990) noted that organisations have a range of techniques and tactics available to manage inter-organisational links, notably the specifying of long-term contracts to bring the agent’s and principal’s objectives into line, the renegotiation of contracts to reduce moral hazard, and the use of shared directors, resources and joint ventures. Both agency theory and resource dependency theory imply the use of deeper social linkages to overcome uncertainty and risk in inter-organisational relationships and do not meet the requirements of anonymity in the classical concept of a market. Baker develops this further to identify the manipulation of the number and intensity of market ties as a means of overcoming market uncertainty. In Baker’s model of market networks inter-organisational relations are viewed at three levels. At the lowest level of analysis, dyadic inter-organisational relationships are seen in isolation. Baker rejects analysis at this level because the analysis of single linkages will not uncover the strategy for manipulating linkages. At the highest level the sectoral network of linkages can be studied, but Baker argued that this macro network analysis would usually be at a level beyond the control of individual organisations. Baker’s analysis focuses on the intermediate level of the organisation set (Evan, 1966), studying the pattern of links between a focal organisation and the organisations it has relationships with. Baker, adapting the markets-hierarchies dichotomy from Williamson, categorised the networks on a continuum between “*relationship interfaces*”, in which the level of commitment to the inter-firm relationships border on a substitute for vertical integration and hierarchical control, and “*transaction interfaces*”, in which relationships are “*short-lived, episodic and random*”. Baker argues that most organisations follow strategies mixing the two, which he terms “*hybrid interfaces*”, with a mix of long-

term committed relationships and a larger number of transient transactional ties. Baker (1990) hypothesised in his study of capital markets that the split between relationship and transactional ties would be affected by *criticality* (the availability of alternatives), *intensity* (the amount traded), *asymmetry* (the relative importance of the transaction to both parties) and *standardisation*.

It is recognised that in addition to the physical resources there is also the human capital, including the expertise and skills of those involved. Coleman (1988) extended the concept that an industrial sector comprises the physical capital invested in it by members, including technology and facilities, to define a further class of capital, social capital, which recognises that investments in interpersonal linkages have value, for example through increasing trust. Coleman identified that the most significant difference between social capital and human or physical capital is the difficulty of appropriating the benefits of social capital. Whereas an investment in new processes can be appropriated and the benefits of the training of staff realised if the staff do not move on, the benefits of social capital accrue to all those in a network. The less extensive the network the greater will be the benefits of investing in the network's social capital. When applied to market networks the implication is that in a classical market, corresponding to transactional relationships in Baker's taxonomy, there is no incentive to invest in social capital, and that where there is such an investment it implies the formation of a sub-set of traders within the overall market.

### *Markets as Social Networks*

That markets are a socially constructed space in which people play roles rather than a system of economic transactions driven by a search for economic efficiency is recognised in studies by Geertz of the suq in Moroccan society (Geertz, 1979) and de la Pradelle in French rural markets (de la Pradelle, 1995). Markets may be viewed as either institutions regulating the exchange of goods or social structures in which this exchange takes place. From a functionalist institutional perspective markets include the dissemination of information about articles for sale, information about articles wanted, control the hand-over of ownership, the determination of price and the dissemination of information about prices. Markets have three phases: the pre-announcement of what is for sale and when; the negotiation of price and transfer of ownership; and the dissemination of information about prices achieved in the market. It is feasible to use information technology to automate each of these three phases. Markets may also be characterised by their area, whether a local market or a market covering a large area, and by their openness, whether they are only available to select traders or whether they are open to participation by anyone. Following the logic of Bakos and Henderson, electronic markets overcome the limitations to market boundaries posed by the cost of travelling to physical markets. However, this functionalist view does not allow the processes involved in building the market from diverse buyers and sellers to be analysed. Even at its most minimalist level,

because a market must include at least one seller and one buyer, a market is a social network. Even in the most basic local British livestock auction it is difficult for the outsider to understand what is going on. Sellers, buyers and auctioneers all take on complex roles in the market without having to explain or announce what is happening. The social structures embedded in the auction have developed through centuries of livestock trading, and it is this social structure rather than a blank sheet that electronic markets had to be overlain.

### **The Evolution of Agricultural Markets**

While the auctioning of livestock in a local auction market appears a timeless element of British life, the auction market system has developed in response to wider social changes. The auction market is a highly developed social system involving sellers, buyers and auctioneers. The need to trade agricultural produce even in primitive societies means that markets are amongst the oldest social institutions. Once a society realised the potential of trading its surpluses in exchange for products they did not have, they discovered trade and the market. The simplest form of trade took place through bilateral deals: a trader would arrive at a settlement offering ten bags of corn for a cow. In this type of trade the seller would have been at a disadvantage relative to the trader, not knowing whether there was a shortage of cows or a glut of corn. The trader would also have either to scour the country in a random search or restrict their trade to a smaller circle of social contacts. This peripatetic trading is still seen, with the same disadvantages, when *soi disant* antique dealers trawl the country for antique furniture, where the cost of extensive cold calling is balanced by the profits to be made by buying antiques from ignorant sellers who have no idea what their property is worth. In medieval Europe the inefficiencies of direct trading led to the emergence of town markets and fairs, where at set times buyers and sellers would congregate in a public place to negotiate sales, with the prices achieved and the quality of the goods visible to all buyers and sellers. In this more transparent market a seller would have competition between potential buyers and the buyer would save time, knowing that goods would be available. The formation of markets and fairs, by locating trade in fixed locations at fixed times, also made it possible to charge levies on sales through the market, making the operation of fairs and markets in Britain a source of funds for the burghs and manors granted charters to hold them. The emergence of fairs therefore reduced the search costs of buyers, provided an exchange of price data and enabled trade to be taxed. The trade within the fairs was institutionally simple, with cattle and sheep penned by movable hurdles and no organisation of the business, with buyers and sellers negotiating bilaterally. To prevent the avoidance of the tolls charged for selling stock through fairs, they were legally regulated. From the middle ages buyers would avoid market and fair tolls by intercepting and buying stock

being driven to fairs. This practice undercut the revenues gained by the owners of the fair rights and became the crime of forestalling<sup>19</sup>. Rogers reports that fairs still suffered from forestalling in the early twentieth century, although it was no longer considered so odious (Rogers, 1904).

Prior to the middle of the nineteenth century the majority of livestock were traded at large fairs where buyers and sellers haggled over the prices of stock. Dependence on these infrequent fairs caused problems for farmers, who if they needed money between fairs would have to sell for a low price. The complexity of moving and selling stock in towns made the by-passing of the fairs nearly impossible. By the start of the twentieth century fairs were primarily used by small scale dealers and were being replaced by the growth of auction sales operating in purpose built accommodation (Rogers, 1904). In *Far From the Madding Crowd*, Thomas Hardy described Greenhill Fair, based on the September Fair on Woodbury Hill near Bere Regis. This market was awarded its royal charter by Henry III in 1216. Hardy saw this fair during its last years of livestock trading, with sheep sold for the last year in 1906, displaced by the auction market in Dorchester (Addison, 1953, p 184). As regular livestock markets grew the large annual fairs declined. At most fairs, for example the Nottingham Goose Fair, the trading of livestock died out and the fair evolved into a carnival. By the early twentieth century it was only horse dealing at fairs that was not dying out (Rogers, 1904), of which Appleby New Fair in Cumbria is the last example at which livestock trading continues. Every first weekend in June gypsies travel from all over England to Appleby to trade horses. The horses are paced on the roads near the town and the buyers and sellers negotiate to decide a price for the horse being inspected. In this market it is the buyer's experience which determines how successful they will be at assessing the stock for sale and therefore how successful they will be as a trader. Now few gypsy and traveller families depend upon the horse for their living, but horse trading at the fair has survived because of its importance for gypsies in maintaining their distinctive culture (Thorburn, 1996).

The fairs were replaced during the nineteenth century by regular local markets, often operated by private companies. By the middle of the nineteenth century most large English towns had weekly or twice weekly fatstock sales, with nearly every town having a monthly cattle market for local butchers, with the surplus bought by dealers for shipment to the larger town markets by rail or sea (Perren, 1978, p 16). In these markets the trading was more organised than in the fairs and auctioning of livestock was increasingly used to gain the maximum price for sellers. In the second half of the nineteenth century markets were established in nearly every British town, so that almost all farmers were within driving distance of a

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<sup>19</sup> The regulation of medieval markets also included the offences of ingrossing, the buying up of a monopoly position, and regrating, the buying and then reselling of stock in the market, demonstrating that the penalising of anti-competitive behaviour has a long history.

livestock auction, which would generally be located adjacent to a rail yard for transporting the slaughter stock to either urban markets or abattoirs. By the end of the century there were 900 livestock markets operating in Great Britain, with auction sales taking place side-by-side with sales by private treaty (Rogers, 1904, p 100). However, the pattern in markets of buyers basing their valuation on a direct inspection of the stock was not universal. In the nineteenth century buyers at the Inverness character fair held in mid-July were willing to buy on reputation and description. The sheep being traded were dispersed across the Highlands of Scotland and would have deteriorated if they had been driven the long distance to a market. The buyers negotiated based on the reputation and character of the seller and a description of the stock. Although the sale took place in July, the stock would not be taken off the farms until September (Rogers, 1904).

### **Auctions**

In the earliest British livestock markets the sales mechanism was the same as in the fairs, with buyers and sellers negotiating bilaterally. However, through the nineteenth century the market operators and third parties increasingly organised the selling, advertising and auctioning stock to gain a higher price for the seller in return for a commission. Auctions cover a range of sales mechanism in which lots are offered competitively to multiple buyers. The majority of auctioning in use is at the primary market level. Cassady argued (1967, p 20) that auctions are used where there is no "standard" value" of the item being offered for sale and that in secondary markets the existence of known trade prices removes the benefit of auctions. The costs of trading by auction are higher than the costs of trading by direct deals, so will be avoided for *"standardised products under normal supply and demand conditions"* (Cassady, p21).

Cassady, in his global survey of auctions, identified three basic types of auctions. First, English auctions in which the auctioneer seeks new bids higher by an increment than the highest existing bid, with competing bidders progressively raising the offered price until only one bidder remains in the auction. Second, Dutch auctions where the auctioneer offers the lot at a high price and then progressively reduces the price until someone bids, who then has the lot at that price. Third, Japanese auctions, or whisper auctions, in which the auctioneer either goes to each bidder who whispers their bid or all bidders make their offers simultaneously. Analytically the Japanese and Dutch auction mechanisms are equivalent. In an English auction a bidder should bid up to their valuation of the lot, at which point they are indifferent about whether they are successful or not, while in Dutch auctions the bidder bids above their expectation of their opponents' bids, if that bid will still be less than their own valuation (Thomas, 1984). It follows that bidders will bid higher in English auctions than in Dutch auctions, but Dutch auctions have the advantage of being able to process lots faster than English auctions.

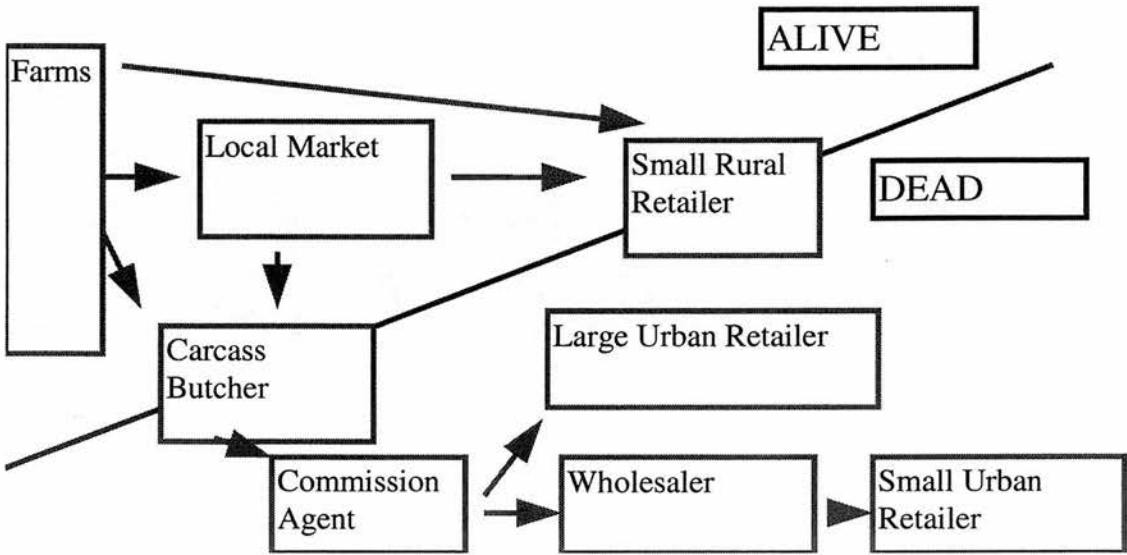
The earliest reference to "auction" cited in the Oxford English Dictionary is from 1595. By the late 17th century sellers of pictures were regularly holding auctions in taverns and coffee houses (Cassady, 1967). One of the earliest descriptions of an auction in agricultural produce is of fish sales in 17th century Yarmouth (Westerfield, 1915, p208). Each boat landing fish was tied into selling their catches to a specific "oast" (fishmonger), who was also a freeman of the town. The first boat to land its catch on each tide agreed a price with their oast which then became the price for all following boats on that tide to sell to their own oast. According to Westerfield the oasts exploited their monopoly position with boats to force the prices down and the system was changed. In the revised system the oast of the first boat took half of its catch with the other half being auctioned by the town chamberlain to the other oasts. The price achieved at auction then became the price for all catches landed on that tide. This idiosyncratic practice ceased in 1728. Livestock auction marts appeared in England for the first time in approximately 1836, but it was only following the ending in 1845 of the tax on auctioning moveable properties off farms that it was possible for auctioning in markets to become widespread (Rogers, 1904). Also, in the mid-nineteenth century, there was resistance to auctioning in British livestock markets because sellers feared collusion between buyers. However, auctions were widely used by large breeders of livestock who held auctions on their own farms (Perren, 1978, p29). Increasingly firms which had experience in auctioning real estate and other goods saw that they could offer an auctioning service in the cattle markets or even set up markets of their own. This link is still seen in the large number of livestock auctioneers who are also chartered surveyors and estate agents. Typical is the development described by Learmount (1985, p68), who recounted the history of Buckland and Son, livestock auctioneers in Buckinghamshire. Thomas Buckland was a farmer in the early nineteenth century, farming near Windsor. In 1826 he founded a company to operate as a land valuer and agent. With the building of the railways, and the need for calculating compensation for landowners affected, his business grew. In 1850 he opened Slough Cattle Market on land adjacent to the Great Western Railway. In the late nineteenth century the use of auctions for trading agricultural produce was appearing elsewhere. In 1887 a Dutch vegetable grower named Jongling arrived with a bargeload of vegetables at the harbour at Broek op Langendijk. Conventionally the load would have been sold privately to a dealer, but on this day there was a shortage of vegetables and a number of eager buyers. A passing boatman suggested that he auction his vegetables. In Germany the first fish auction was held in Hamburg on May 1 in the same year (Cassady, 1967).

In the 1880s increasing meat imports from Argentina and the United States led to pressure to improve the efficiency of the domestic meat trade (Perren, 1978). One aspect of this was dissatisfaction with livestock markets, which were seen as being run for the benefit of the owners rather than the benefit of buyers and sellers. The Royal Commission on Market Rights and Tolls (1887) carried out a detailed survey of markets

and fairs, interviewing people involved in them from across the United Kingdom. The commission recommended that more accurate price reporting in markets would benefit the industry (Perren, 1978, p 141). Pell, in evidence to the Commission, explained that selling by weight was the normal pattern of trade in the United States, but that in the United Kingdom butchers were unwilling to buy weighed cattle. An example was cited in evidence of butchers refusing to buy any stock from sellers who had had any of their stock weighed (Report of Royal Commission on Market Rights and Tolls, 1887, p 293). Thomas Swan of Edinburgh explained to the commission the benefits to the industry of price reporting by weight. At that time 600 of the 800 to 1600 cattle being sold through his Edinburgh market were being auctioned by weight with a description of feeding. He noted the potential benefits of better price information for the producer: *"Another great advantage that I see in selling cattle by weight is that it educates the farmers to see the classes of cattle likely to pay the best"* (Swan, p303). The Royal Commission's report led to the passing of the Markets and Fairs (Weighing of Cattle) Act 1887, which made it mandatory for markets to provide weighing facilities but not mandatory for sellers to use them. Rogers reported in 1904 that in most parts of Britain farmers and butchers were unwilling to use the weighbridges provided, with the proportion of stock weighed higher in Scotland than in England. In 1901 only 13% of cattle and 1% of sheep were weighed in scheduled markets (Rogers, 1904). The Markets and Fairs (Weighing of Cattle) Act 1926 made the weighing of cattle in markets and the notifying of bidders of the weights mandatory (Harvey & Meissel, 1995). Studies had shown that farmers were far less able to estimate the weights of their stock than dealers, tending to underestimate their weights, and that this led to farmers accepting poor prices (Perren, 1978, 141 - 142).

By 1914 there existed parallel channels for livestock sales. In rural areas butchers were still buying small lots direct from farmers, but most sales passed through local auction markets (Perren, 1978). There existed two tiers of auction sales: local auctions selling mostly to dealers, held one or two days before the market in the nearest large town; and large urban markets, in which stock would either be consigned by the farmer or would have been bought by dealers in smaller local markets. The small local sales had increased after 1890 because, whilst prices were lower than in the urban markets, the selling costs and time required were lower for farmers (Perren, 1978, p 144). The livestock markets had become one link in a chain linking the rural farmers with the urban consumers. While the auctions had a role in determining the prices of livestock, they were also important as a stage in the distribution of livestock. Between the farmer and the consumer were carcass butchers who bought animals for slaughtering, commission agents who distributed carcasses to large urban retailers and wholesalers, and wholesalers who supplied smaller urban retailers.

Figure 1: Structure of United Kingdom Meat Supply Chain in Early 20th Century<sup>20</sup>



The trading of livestock through live markets has remained the dominant marketing channel in the United Kingdom through the twentieth century. All over the UK farmers still bring their stock to local auction markets run by small local auction companies. The stock is shown to potential buyers, after which the auctioneer auctions the stock seeking the bidder who places the highest valuation on the stock. Again, the skill of the buyer in accurately assessing the value of the stock will be key: with slaughter stock the buyer must predict the quantity and quality of the meat that will be available after slaughter; with store stock the bidder must predict the value of the stock after they have been fed and are ready for slaughter. The successful bidder then transports the animals from the auction to the abattoir or the buyer's farm. In this system animals undergo two journeys: from the farm to the auction and from the auction to the buyer, causing the animals to lose weight. If animals are not bought, they have to be transported back to the farm and the farmer incurs greater costs. The form of trade in livestock auctions has changed little in a hundred years, and though anachronistic, is seen as socially significant to the farmers, auctioneers and traders who use the mart, and almost equally to the population of the market towns. The market for livestock has a significance which goes beyond its role as a mechanism for matching the producers of livestock with people who want them and a means of determining the "fair" price. The trading of slaughter livestock is characterised by a large number of geographically dispersed sellers and a smaller number of large purchasing abattoirs. The structure of physical livestock auctions in the UK was fixed in the late nineteenth

<sup>20</sup> Derived from Perren, 1978, p 144.

century as government imposed regulation led to the establishment of locally owned auction marts at railheads.

While the auction market became the dominant means of livestock trading in Britain, corn trading became dominated by specialist corn merchants who negotiated private deals with producers and users. Everitt (1967) noted that these traders depended upon their local knowledge: *“Private marketing was not without its own strict body of custom, and its bonds were still personal and local. It was, in a word, a system of enterprise operating within a network of personal contacts.”*

Auction selling of livestock also became the dominant pattern in North America and Australia. Up to the Civil War most United States farmers sold their livestock to itinerant drovers, who herded them to a city market where they sold them to jobbers, who in turn supplied individual butchers (Schlebecker, 1975). Up to the 1860s most towns held weekly livestock markets, with the ignorance of farmers about wider market conditions leading to large variations in prices, both through time and geographically. In 1830s this price volatility was reduced when newspapers, initially in Boston, started to publish market prices. The publication of market prices led in the 1830s to pig farmers feeling sufficiently confident to enter into supply contracts with processors, bypassing the markets. The arrival of the railways led to a decline in the local markets and the growth of large terminal stockyards, for example Chicago, Omaha and Denver. After the Second World War the importance of the terminal stockyards declined in the United States, with local stockyards becoming more important. According to Schlebecker (1975, p131) this change was due partially to the changeover from rail to truck for transporting livestock and partially due to the stockyard companies and the packers wanting to relocate out of urban areas into dispersed rural locations to break the militancy of their workforces. By 1951 there were 2500 stockyards in the United States (Schlebecker, 1975).

### ***Direct Selling***

For the last sixty years the meat industry has become increasingly concentrated, with the emergence of large meat processing corporations, the decline of small independent butchers and the closing of small abattoirs due to over-capacity and the imposition of tighter regulation. As the power of the large meat companies has grown, there has been a growth in the purchasing of stock direct from farms, bypassing the physical market. The traditional physical market is inefficient because of the costs of animal transportation, the time required for participation by both buyers and sellers and the distortion of prices in local markets due to the shortage of buyers.

In the second half of this century auction markets have been in decline almost everywhere in the world. Increasingly producers chose to trade directly with processors rather than trade anonymously through the auction. While producers can trade directly on a lot by lot basis, in many cases this led to the agreement of longer-term supply contracts between producers and processors. By 1990 the proportions of agricultural products sold by contract in the European Union had grown, but with wide variations between nations and between commodities.

**Table 1: Products Sold Under Contract 1990 (%)<sup>21</sup>**

	Be	Den	Ger.	Sp.	Fr.	Ire	It	Lux.	NL	Port	UK
Pigmeat	55	0	-		30-32	-	-	15	35	-	70
Calves	90	0			30-35	-	-	-	85	-	1
Poultrymeat	90	-			45-50	90	-	-	90	-	95
Eggs	70	-			15-20	25	-	-	50	-	70
Milk	-	-	99		1	10	-	-	90	-	98
Sugarbeet	100	100	100	100	100	100	100	-	100	-	100
Potatoes	20-25	40			8-10	8-10	-	-	50	0	14
Peas	98	100	92		90	100	-	-	85	95	100
Canned tomatoes	-	-	-		-	-	100	-	-	100	-

The growth of contract trading had impacts for the structure of agricultural industries, favouring large producers able to supply large quantities of product at consistent quality, spread over time, and leading to production becoming concentrated close to the processor's plant, as is seen in sugar beet and pea

<sup>21</sup> Source: CEC, 1993.

production (Bowler, 1996, p 66). The growth of contract farming was viewed pessimistically from a radical rural sociology perspective by Davis (1980) as reducing the idealised autonomous farmer: *“to a wage earner on his own land - a piece worker who provides his own tools and works under supervision to produce commodities which he does not own. He sells his labour power instead of chickens, beans or beets.”*

The decline of auctions was seen as a public policy issue because producers generally, whether farmers or fishermen, tend to be smaller than the processors, have less access to detailed information about the current balance of supply and demand in the market and have less knowledge about customer preferences, leading to them being weaker in bilateral negotiations (Hayenga, 1979). Also, the increasing concentration of processing in many industries was seen as leading to the local appearance of “thin” markets in which there were a small number of potential buyers and therefore little apparent competition (Hayenga, 1979). However, while this decline of markets has affected many agricultural commodities, it is important to recognise that many agricultural products have rarely been auctioned, for example farmed fish.

The United States has a long history of competition law seeking to overcome the abuse of oligopsony in commodity markets<sup>22</sup>. The decline of large-scale centralised auctions markets was leading to the view that prices were no longer representative of the underlying balance between supply and demand. This was seen as a particular policy problem in the United States where the large centralised auctions were being displaced by smaller local markets, direct buying and contract production. Penson et al. (1996, p 226-228) in a standard agricultural economics textbook saw the traditional first level market of feeder stock as an example of perfect competition: *“producers of feeder cattle, feeder pigs and feeder lambs ... ..closely resemble perfect competitors. The actions of an individual producer have little or no effect on the market.”* However, Penson et al. saw the relationship between feeders and the meat processors (packers in United States terminology) as problematic because the packers behave as oligopsonists in buying slaughter animals, with farmers believing that prices are held down because the packers follow a non-aggressive buying policy. In the United States a need for legislation to control anti-competitive behaviour in the livestock industry had been recognised in the twenties, with the Packers and Stockyards Act of 1921 forcing some livestock yards into public ownership and regulating the sale of livestock and the commissions charged. The Capper-Volstead Act of 1922 allowed producers collectively to establish marketing agencies if operated for mutual benefit and the Cooperative Marketing Act of 1926 permitted farmers to exchange price information. However, marketing agencies and bargaining associations have not been as significant for entrenching the power of the farmer in the United States because producers leave

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<sup>22</sup> See for example in 1919, United States versus New England Fish Exchange, 258 Fed 732 (1919)

the associations but trade on the association's achieved prices (Cramer & Jenson, 1985, p193). This free-riding led to the strength of many associations being reduced through time (Cramer & Jenson, 1985, p 193). The proportion of feeder cattle passing through live markets in the United States was falling in the nineteen seventies as feed-lots and packers increasingly bought directly from ranchers (Schlebecker, 1975).

While academics from an agricultural economics perspective saw increasing concentration amongst buyers and the decline in auctions as being a problem, for rural sociologists it was a less pressing issue than the decline of family farms and the rise of "agribusiness", the term coined by Goldberg (1968) for the emergence of large vertically integrated corporations in the food and agriculture sectors (Martinson & Campbell, 1980). When addressing the structural changes in the agricultural industry rural sociologists often accepted the evolutionary rationale of agricultural economists that the underlying efficiency of large farms and large processing corporations was leading **inexorably** to the decline of small scale farming and processing, and then focused on the social changes following from this evolution. For example, Newby (1983) adopted a crudely determinist view of structural change, arguing that "*what regulates the concentration of farming is the degree of technical efficiency by which large farms may establish their superiority in a competitive market.*" It has been left to economic historians and anthropologists to point out that the diversity in agricultural industrial structures which have emerged throughout the world cannot be fully explained by reference to operational efficiency and that this diversity shows remarkable resilience.

### ***Electronic Markets***

It was recognised in the 1960s that using inter-organisational systems to link buyers and sellers might improve the efficiency of marketing agricultural products (Henderson, 1984). Henderson, Schrader and Turner (1976) produced an influential paper for the United States Senate Committee on Agriculture and Forestry, arguing that the decline of live markets and the growth of large processors was leading to inefficient trading of agricultural commodities and that electronic markets could strengthen the small producers relative to large processors.

Henderson et al. (1976) proposed electronic markets as a solution to the problem of "thin" markets for agricultural commodities, characterised by low volumes traded, a lack of competition between buyers, inadequate information, inaccessibility to traders and a high potential for price manipulation. Electronic markets potentially reduce the cost of bringing buyers and sellers together and reduce the cost of completing the transaction (Graham et al, 1994). The case for electronic markets was based on separating

the two functions of the traditional market: the negotiation of the sale price and the physical transfer of possession. An electronic market provided the possibility of bringing together a large numbers of buyers and sellers to produce a competitive market in which prices are determined, with the products traded moving directly from the seller to the successful buyer. Henderson et al. (1976) recognised the importance of product description in a market in which the products could not be inspected by potential purchasers, but noted that selling by description using standard classifications was used for a wide range of agricultural commodities. The significant point which they overlook is that these description based sales were not using an auction mechanism, so it might be deduced that in sale by description the reduction of uncertainty about the value of the product is reduced to the point that it is not necessary to auction.

Henderson et al. (1976) proposed a general model for electronic trading. Sellers would describe their product using standard grades, with third-party inspectors used where grading is complex. Lots may be combined, or co-mingled, to produce lots of a size of greater value to buyers. An offer to sell is communicated to potential buyers using a telecommunications network which may then be used to receive offers for the lot. Henderson et al. (1976) claimed that within this standard pattern there was scope for varying the telecommunications media used, the method of negotiating the sale (manual trading houses, telephone auctions, teletype auctions, and computerised trading houses) the frequency of the sale, the sale's geographic coverage and the range of commodities traded.

In a manual clearing house the telephone is used to match buyers and sellers (Henderson et al. (1976) cites the Egg Clearing House Inc. as an example). In telephone auctions conference telephone calls are used to link potential buyers and lots auctioned conventionally (Henderson et al., 1976 cites a Virginia telephone auction, Tel-O-Auction). Teletype auctions were essentially similar to telephone auction except that telex machines are used to link buyers to the central auctioneer, (Henderson et al., 1976 cites the Ontario Hog Producers Marketing Board). Computerised tradinghouses use a computer to replace the role of the human auctioneer (Henderson et al., 1976 cites Telcot, a system operated by the Plains Cotton Cooperative Association).

Henderson et al. (1976) claimed that there were four necessary conditions for an electronic market to be successful:

1. Potentially competitive market: while currently there may not exist competition between buyers for the commodity, there has to be the potential that in the electronic system many buyers and many sellers will be competing to trade;

2. Trader interest: traders must perceive a need for a more competitive market and be willing to trade by description. They claimed that reduced contact with intermediaries might make interest in using electronic trading systems difficult to maintain;
3. Accurately describable commodities: products must be described in terms meaningful to buyers and sellers;
4. High volumes: commodities must be traded in large quantities in order to provide “*market liquidity and interest*”.

Henderson et al.(1976) also identified four conditions which they claimed must be achieved within a successful system:

1. Trader education: electronic selling is claimed to be complex and foreign to most potential traders, so the practice and advantages must be explained to them;
2. Performance guarantees: users must be confident that trades are guaranteed to avoid the fear of malfeasance;
3. Grading systems: development or adoption of meaningful grades and a means for third party inspection;
4. Large volume trading: large volumes are claimed to be necessary for accurate price and efficient trading.

Henderson et al.’s analysis, unsurprisingly for academic agricultural economists, concentrated on the factors necessary for making electronic markets economically viable, without adequately addressing potential resistance. It is implicit in this analysis that a more competitive market will increase average prices in thin markets, so it is possible that buyers will not find the prospect of electronic selling attractive. The wide advantage of electronic markets identified by Henderson et al. was price accuracy, with prices accurately reflecting supply and demand, and geographic price differences not due to quality or transport costs being smoothed out. It was claimed by Henderson et al that electronic market systems would provide more accurate information about prices achieved and would improve communication from buyers about the product attributes they were looking for. Henderson et al.’s discussion of the impacts of electronic markets is overwhelmingly positive, only noting in passing that “*local monopolistic traders, of course, would lose their economic advantage.*” Henderson et al.’s discussion of the effects of electronic markets concludes: “*a successful electronic market would result in more efficient use of economic resources by lowering the costs of buying, selling and transportation. Improved co-ordination means resources would be used for nearly optimal purposes. And economic power would be more evenly distributed. Theoretically, all segments of society benefit from economic gains in any part of the economy*” (Henderson et al., 1976). Henderson et al. noted that the formation of electronic markets involved high

start-up costs and a need to achieve high trading volumes. They identified two routes by which this critical mass barrier could be overcome: through voluntary action or by mandate: "*Voluntarily, producers and/or buyers can organise, develop a workable model fitting their product characteristics and geographical area, gain contractual commitments from enough traders to assure a reasonable chance of success, then interest a new or existing marketing agency in providing the service*". To create a "*mandatory or quasi-mandatory system*" potential users could seek a government grant to finance development and initial operation, with legislation used to mandate producers to use the market. They note that the most successful system at that time, the Ontario Hog Exchange, was mandatory and conclude that "*some mandated use may be necessary to achieve sufficient volume for maximum benefits*", justifying this policy intervention on the basis of the public good benefits of more efficient markets (Henderson, Schrader & Turner, 1976).

Henderson readdressed electronic markets in 1984 following his direct involvement in United States government funded pilot electronic market for pigs, HAMS (Henderson, 1984). In 1984 Henderson's discussion of electronic market still included teleauctioning, with or without video, in which products are sold by an auctioneer to buyers connecting by telephone; teletype auctions, where a network of teletype printers is used to supply potential bidders with descriptions of lots and to allow them to bid; telephone clearing houses, where an agent matches telephone offers and bids; and computerised trading networks, where buyers and sellers interact using computer terminals connected to a central computer. However, Henderson argued that the term "electronic marketing" should be limited to computerised networks which "*utilize an open, competitive price establishment procedure, such as some variation of auction*". Henderson implied that computerised trading would displace the other forms of trading because of the ability of networks to handle large volumes of data and that computer usage was growing in the agricultural sector. Henderson (1984) argued that electronic markets were more efficient than conventional live markets because broader buyer and seller participation increases competition and facilitates the dissemination of market information.

Sporleder (1984), another academic agricultural economist, considered the effect of electronic trading on the structure of agricultural commodity markets. He characterised agricultural producer/first buyer markets as markets in which competitive sellers face oligopsonistic buyers, arguing that the existence of spatial sub-markets, the perishability of commodities and the distances between actors leads to a chain oligopsony. Search costs for buyers are related to volumes and distances, disadvantaging small buyers. Sporleder concluded that electronic markets will relatively be to the advantage of small buyers, who are weak due to information asymmetry. Where intermediaries fulfil the role of transferring information between buyers and sellers Sporleder predicts they will decline. In electronic trading buyers would buy from a larger area, leading to greater competition in local markets. This would lead to greater global

concentration, with a smaller number of large national processors, but lower local concentration, due to all the buyers being active in each market.

### **The Pressure for Electronic Markets**

By the late nineteen seventies the availability of computers had made electronic markets technically feasible. However, to build electronic markets required them, in the terminology of Callon, to be problematised, with electronic markets seen as the solution to a need. In the United States decreasing competition in agricultural markets had been recognised by government officials, existing intermediaries and academic agricultural economists. Of these three groups, agricultural economists, notably Henderson, Sporleder and Schrader, were influential in proposing electronic markets as a response to perceived failures in existing markets. While sociological analysis of markets had identified the complexity of social relationships within markets, the analysis of Henderson et al was based on a reductionist conception, agreeing with Smith that social relationships in the markets were “a conspiracy against the public”. For them direct buying and thin markets represented imperfect competition and market inefficiency, whereas electronic markets offered the prospect of competitive markets with large numbers of sellers and anonymous buyers. The following four chapters will describe how these arguments were deployed in North America, the Australian livestock industry, the United Kingdom livestock industry and the European fish industry to justify and shape electronic market systems, and how existing social relations affected their persuasiveness and shaped the electronic markets which emerged.

## **4. North American Electronic Markets**

*Chapter 3*

*North American Electronic Markets*

## **Introduction**

This chapter provides an account of the development of electronic markets for agricultural produce in North America. The large distances within the United States separating agricultural producers and urban consumers made remote selling relatively attractive following the economic logic of Bakos (1991) discussed in chapter 2. The earliest systems were created in the forties using teletype machines to link buyers to the auction. In the seventies auctions using computers overcame the technical limitations on the scale and scope of teletype auctions. The success of the Telcot computer based auction for cotton led to the United States Government identifying electronic markets as a means of maintaining competitive markets in the face of growing processor concentration. The USDA supported the development of six diverse pilot electronic markets through universities. The failure of these pilots led to the realisation that the greatest barriers to the establishment of electronic markets were overcoming the resistance of both buyers and sellers rather than the technical problems of writing the software and proving the hardware, and ensuring consistent descriptions acceptable to buyers. The only one of the pilots to continue beyond the pilot was NEMA, a computer based lamb auction. Specifically, the lessons learnt from NEMA were the importance of involving existing market intermediaries and as closely as possible simulating the procedures of the existing markets. The NEMA system provided a template for similar privately funded Canadian systems. More successful than electronic livestock markets have been commercially developed satellite video auctions, which provided the benefits of remote auctioning whilst more closely emulating the structure and processes of the live market.

## **Teletype Auctions in North America**

The earliest automated auctions in the United States allowing remote bidding were networks of teletype (telex) machines. The first commercial teletype auction in North America was Selelevision in the mid 1940s which was used to sell Florida citrus fruit (Cassady, 1967). This was a teletype auction using a rising bid. Florida citrus fruit was offered to buyers across the United States, with potential buyers supplied with descriptions of the fruit. The system used teletype machines at selling and buying points, a machine at the seller to co-ordinate bids and a time clock for indicating the seven second delay in which bids had to be made. The bidders screen showed the current bid, a bid would increase this incrementally and if a bid was not made during the seven seconds delay the screen would show "sold" (Cassady, 1967, p 198).

## **Telcot**

The first computer-based auction to operate commercially was the Telcot system for marketing cotton. Cotton marketing in the United States was traditionally carried out in small local markets (Ethridge, 1978). The Plains Cotton Cooperative Association (PCCA) was founded in 1953 to market the cotton produced by its 20,000 members in Oklahoma and Texas (Bogs, 1980). In the seventies PCCA members were increasingly selling directly to brokers, with PCCA's share of their members' trade falling from 70% to 20% (Lindsey et al., 1990). To counteract this growth in direct sales, in 1975 PCCA developed Telcot as a computerised cotton marketing system, covering West Texas and Southwest Oklahoma.

Telcot was initially developed by IBM contract programmers. One of the IBM project team, D Lindsey, then left IBM to set up a permanent development team at PCCA, later becoming PCCA vice-president of operations. Telcot used MVS/ESA, CICS, COBOL and SNA communications (Lindsey et al., 1990). In 1980 the 300 terminals were mainly IBM 3275 with SNA connections to the central computer, a recently purchased IBM 3031, using leased data lines (Ethridge, 1978). In 1990 Telcot connected 200 gins and 40 buyers using an IBM3090 mainframe computer supported by 20 programmer/analysts. In 1989 TELCOT's operating budget was \$5.5M and it traded 2.1M bales from a total United States production of 15.4M bales (Lindsey et al., 1990). By 1996 Telcot was using FM radio, ISDN lines and satellite to link gins to the system. According to Lindsey et al (1990), Telcot transformed PCCA from a small cotton merchant into a major cotton broker. Whereas PCCA operated by buying and then selling its members cotton, by 1990 it was only buying 30% of its members' production. Dan Davies, President of PCCA, invested \$2M to set up Telcot, with PCCA's turnover growing from \$50M per year to \$500M in fifteen years (Lindsey et al., 1990). Martin (1985), on his study tour from Britain, saw TELCOT's success as being because it developed as an extension of the existing marketing mechanisms.

The network in 1983 included terminals in over 350 cotton gins and in over 55 cotton buying offices throughout the United States . Telcot offered the seller a choice of market mechanisms (Bell et al., 1983). The first mechanism was the "blind bid" in which lots were offered for fifteen minutes and the highest offer received, assuming it exceeded the reserve price, was successful. More commonly used was the "firm offer" in which the seller specified an offer price at which buyers could buy the cotton. If no offer was made by a buyer, the seller could change the offer price or withdraw the lot (Bell et al., 1983).

In the United States cotton is marketed in a wide range of qualities. In the Smith-Doxey classification there are 45 grades, 23 staple lengths and 7 micronaire groups, giving in theory a total 7245 categories. Cotton is graded by the USDA in the storage warehouse (Martin, 1985). Grade is a measure of colour and trash content, staple is the length of the fibre and micronaire represents the maturity of the fibre. There is a

legal requirement to supply a six ounce sample from each 500 pound bale for testing by the USDA (Lindsey et al., 1990). Producers sold cotton in mixed lots, but shippers sought specific grades to meet their needs, leading to the emergence of local merchants who bought and sorted mixed batches into larger homogenous lots. Producers allowed the gins who processed their cotton to market it to merchants. The use of an electronic market offered the possibility of allowing the gins access to a wider market. Installing terminals in the cotton gin offices was seen as being the most important single step in grower acceptance, allowing growers to see the market in action and receive up-to-date summaries of prices (Ethridge, 1978). PCCA guarantees farmers payment and title passes to the buyer within 24 hours, with buyers and gin operators paying a monthly fee for use of their PC's and communication services (Lindsey et al., 1990).

While Telcot was marketing a high proportion of the cotton produced by PCCA members, many producers were not affiliated to PCCA. Sixty-five percent of cotton produced in the South-western area (Texas and Oklahoma) was being ginned by organisations not affiliated to PCCA (Davis, 1980). Because PCCA was restricted to marketing cotton for its members, it was unable to market this cotton. In May 1978 Dan Davis, who was responsible for the development of Telcot left PCCA to set up CXS (Commodity Exchange Services) to extend electronic marketing beyond the gins which were PCCA members. After a period of negotiation CXS and Telcot agreed to share their facilities (Ethridge, 1978). In 1983 the two parallel service providers were using the same hardware for buyers (Bell et al., 1983). Later two other competing services were set up. In 1985 TELMARK Inc. was founded to extend TELCOT's services to independent gins (Lindsey et al., 1990). In 1987 PCCA unsuccessfully sought an injunction to prevent the use of a personal computer version of a similar system, GEMS, which had been developed by programmers who had worked for PCCA being launched by Goodpasture Computer Services (SLWK, 1997). Telcot developed electronic marketing of futures, including advancing money on cotton to be traded over the system in the future to help members suffering from cash flow difficulties (Ethridge, 1978). Telcot also trades cotton futures and provides market data to buyers and sellers. In 1990 electronic warehouse receipts were introduced. These were legally negotiable documents used by banks as collateral. According to Lindsey et al. "*building the system has proven far less challenging than gaining acceptance of the electronic warehouse receipt by both producers and bankers.*" (Lindsey et al., 1990). The Plains Cotton Cooperative Association guarantees delivery of cotton purchased on the system (Bell et al., 1983). The history of Telcot provides an example of a successful electronic market. However, the circumstances for the development of an electronic market in the cotton industry were propitious, satisfying Henderson et al.'s conditions for electronic market development: with an existing producer co-operative providing a stabilised network of sellers and buyers, the USDA grading scheme providing a foundation for selling on description and high value total sales making the fixed costs of developing an electronic market viable.

## The Background to Electronic Livestock Marketing Systems in North America

The technical and commercial success of Telcot in the late seventies provided an awareness of the technical and economic feasibility of electronic trading. As cited above, the Telcot system was widely described and studied so it is unsurprising that for public administration and academic analysts electronic markets appeared to be a possible solution to the same problems in other sectors, in particular the increasing concentration in the meat industry and the suspicion that markets were no longer competitive and producers were not gaining “fair” prices. However, compared to Telcot, many of these sectors had a wider range of smaller market intermediaries and less well-developed description standards.

The United States’ cattle industry is characterised by a large number of highly dispersed ranchers who breed cattle and graze them on pasture, who then sell them on to feed-lots who intensively fatten the cattle on corn. The former is the stereotypical romantic view of the cowboy on the prairie and the second is agribusiness. With these changes stockyards became increasingly reliant on the sales of feeder cattle and cull cows. However, the proportion of feeder cattle passing through live markets was falling in the nineteen seventies as feed-lots and packers increasingly bought directly from ranchers. Schlebecker (1975) argued that this increasing vertical integration and by-passing of competitive markets was caused by lower costs of transportation and the improved co-ordination and lower risk of trading directly between interdependent firms. As the proportion of agricultural produce traded in competitive markets fell, the fear that markets were no longer representative grew amongst academics and agricultural policy specialists. The fear that auction markets were flawed means of price discovery was exacerbated by the increasing concentration of the meat processors leading to few bidders in many local markets. This was a concern because the prices in the residual live markets were used in formula price setting between firms trading directly. The interest in electronic markets by academic agricultural economists derived from a belief that centralising price discovery with decentralised product flow would provide a competitive market with the operational benefits of direct sales.

By the mid seventies there were computer based electronic auctions operating in the cotton and egg sectors in the United States, but these are small sectors compared to the livestock sector. In 1976 the United States Senate Committee on Agriculture and Forestry reviewed the future areas for the United States’ agricultural industry. One paper presented to the committee was prepared by Henderson, Schrader and Turner, three professors of agricultural economics, entitled *Centralized Remote-Access Markets* (Henderson, Schrader and Turner, 1976). The first two paragraphs of this paper state:

*“Thin markets are characterized by low volume, lack of competition among buyers, inadequate information, unaccessibility to traders, and a high potential for price manipulation. In such markets the validity of prices erodes to the point where they often do not closely reflect the true market conditions, that is, prices generated in thin markets frequently are not representative of actual supply/demand pressures, are not accurate measures of product value.*

*Thin markets result from a movement away from centralized markets to country markets, local auctions, direct buying, and contract production. A major problem occurs when many want to use market prices as the basis for establishing product values but few are using an open market for buying and selling. Centralized, remotely-accessible markets offer an alternative which combines many of the advantages of direct buying and decentralized markets with the pricing accuracy normally associated with large open markets”.* Henderson et al. are then able to cite the ECI egg clearing house, the Tel-O-Auction ( a telephone auction for livestock in Virginia), the teletype auctions and the Telcot electronic auction to demonstrate both the technical and economic feasibility of remote access markets.

Henderson et al. identified four “necessary elements” for success which must predate the system:

Potentially competitive markets;

Trader interest;

Accurately describable commodities;

High volume;

and four “necessary elements” for success which must be created within the system:

Trader education;

Performance guarantees;

Grading systems;

Large volume trading.

Henderson et al. recognised that the design of an electronic market system would be shaped by the existing industry structure and practices<sup>23</sup>. Henderson et al. concludes by arguing that public administration has a role to play in both the establishment and success of electronic markets:

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<sup>23</sup> “A market organisation would have to established, a selling method selected that best fits the industry characteristics and the actual mechanism developed to facilitate trading” ( Henderson et al., 1975, p 13).

*“If the merits of electronic markets are deemed worthy and the conditions for success feasible, how can one be implemented? Most important are commitments by potential traders to use it and by someone to finance its development. Start-up costs are high, and volume trading is essential.*

*There are two basic alternatives for gaining these commitments - voluntarily and by mandate. Voluntarily producers and/or buyers can organize, develop a workable model fitting their product characteristics and geographical area, gain contractual commitments from enough traders to assure a reasonable chance of success, then interest a new or existing market agency in providing the service.*

*There are several alternatives for gaining a mandatory or quasi-mandatory system. Potential users could seek a governmental or institutional grant to finance development and subsidize the initial operation. Legislation could be sought enabling a government agency to develop and operate the system, authorizing a market board to develop it, and mandate its use if approved by a vote of producers; or market order legislation could be amended to order such a market for at least a specified percentage of all trades.*

*To date, the most successful electronic markets have been the Canadian hog markets, mandated by law. Conceptually, voluntary markets are feasible. Some are already in use on a limited scale. Realistically, some mandated use may be necessary to achieve sufficient volume for maximum benefits. Given the “public good” nature of the improved information and other benefits that would accrue, mandatory, or at least quasi-mandatory, use and government subsidization may be justified.”*

Henderson therefore see a role for government in both overcoming the start-up costs of an electronic market and using market regulation, as available for the mandating of producer co-operatives since the twenties, to ensure the viability of the electronic system and prevent it being undermined by free-riders trading directly using the price information produced by the electronic system.

Following the apparent success of Telcote and Henderson, Schrader and Turner's (1976) paper for the United States Senate Committee on Agriculture and Forestry, the United States Department of Agriculture (USDA) Agricultural Marketing Service (AMS) set up a programme in 1978 to support through part-funding the development of pilot electronic markets (Henderson, 1984). Electronic markets were seen by the USDA as a solution to the problem of “thin” markets for agricultural commodities and the decline of large-scale centralised auctions markets (Hayenga, 1979). By March 1980 the USDA had invested \$800,000 in pilot electronic markets, with \$439,000 budgeted to be spent in 1980. Support for electronic markets formed a third policy response to the perceived weakness of producers relative to processors. The USDA also encouraged group action, for example producer co-operatives, and vertical integration (Schlei, 1980). Schlei, the USDA official responsible for electronic markets support, believed that to be successful

electronic markets required reliable technology, high trading volumes, reliable grades and reasonable charges (Schlei, 1980).

### **Meat Grading in the United States**

While Telcot benefited from the existence of a reliable mandatory system of cotton classification, the standards in the livestock industry were less developed. The first United States standards for beef carcass grading were introduced in 1916. These standards have been progressively updated to meet market needs. In 1976 conformation, the shape of the carcass, ceased to be a factor in carcass grading because research had shown the USDA that carcass shape was unrelated to the eating quality of the meat (Boggs & Merkel, 1993). The United States beef carcass grading standards now have two dimensions: quality and yield. The quality grade is based on the degree of marbling of the meat with fat and the apparent maturity of the meat. The more the meat is marbled by fat, the higher the quality. Maturity relates to the physiological age, with the younger the carcass the higher the grade. Carcasses are graded into eight quality grades: prime, choice, select, standard, commercial, utility, cutter and canner. Yield is graded on a numeric scale from 1 to 5, and is based on the percentage of the carcass which can be used to produce standard wholesale cuts of meat (Boggs & Merkel, 1993). It is significant for electronic marketing that *quality* is determined largely by the animal's feeding regime and cannot be accurately assessed by inspection of the live animal. In the USDA classification, feeder cattle are graded for size (small, medium and large) and for thickness of muscling (1,2,3) (Boggs & Merkel, 1993). Lamb carcasses are also graded on a two dimensional scale of quality and yield. The quality grade is a composite of conformation, maturity and condition of the lean flesh, with carcasses classified as Prime, Choice, Good or Utility. The yield grade is a number between 0.1 and 5.9, again related to the percentage of the carcass which produces retail cuts of meat (Boggs & Merkel, 1993).

### **USDA Pilots**

In 1979 the USDA AMS part-funded five pilot electronic markets for agricultural produce: ECI, HAMS, CATS, CATTLEX and EMA, for trading pigs, carcass meat, feeder cattle and slaughter cattle respectively. We shall consider each of these systems in turn.

### **Egg Clearing House (ECI)**

In 1968 Schroder, Heifner and Lanzalere proposed a computerised egg exchange in the United States (Henderson, 1984). In March 1970 the Chicago Board of Trade and the Chicago Mercantile Exchange discontinued their spot egg market. At this time many egg trades were agreed at prices relative to the current Chicago price. Between 1966 and 1969 the USDA and thirteen states supported a study into the

egg market in the United States, leading to the formation in 1969 of the Egg Pricing Systems Study committee (ECI, 1997a). Egg Clearing House Inc. was established in 1971 as a private firm in Durham NH to act as a telephone intermediary in the trading of “nest run” eggs. Prior to 1978, ECI manually matched buyers to sellers, compensating for transport costs. In 1978 this telephone trading was replaced by a computer-based system. ECI installed 55 terminals in buyers and sellers in a project part funded by USDA AMS (United States Department of Agriculture, Agricultural Marketing Service) and the state of Georgia (Bell et al., 1983). The system used a leased computer for collating bids (Toomey, 1981).

ECI trades eggs in morning and afternoon sessions, with each session divided into four periods. During the first period buyers and sellers enter their offers and bids. The computer fixes sales where a bid equals or exceeds an offer plus freight. Bids may be increased and offers lowered during the second period. During the third periods, unfilled offers and bids are traded. In the first three periods if an offer and bid match the parties must trade: in the final period this restriction is lifted (Bell et al., 1983). Bell et al. (1983) noted that ECI users had used the system to discover their best trading policy, then circumvented the system by trading directly: *“Participants in ECI have tended to use the system to discover their best trading alternatives and then circumvent the system by making trades directly. Information about these traders is not available to ECI; consequently their success on providing market information based on negotiated trades has been limited”* (Bell et al., 1983). In January 1980 116000 cases of eggs were traded, representing 0.67% of total United States’ egg production (Toomey, 1981). In June 1997 ECI traded 191,303 cases of eggs in 276 trades involving 89 organisations (ECI, 1997b).

### **HAMS**

The Hog Accelerated Marketing System (HAMS) for computerised marketing of hogs (pigs) was developed at Ohio State University by Denis Henderson. The development of HAMS was a response to falling numbers of pigs passing through live markets, which had dropped to 29% by 1976, a trend which was seen as being detrimental to producers. The HAMS system was developed during 1979 and in spring 1980 terminals were installed in farms, markets and packing plants. It was planned that the system would operate for one year. HAMS development was funded 50% by the USDA/AMS, and 50% by Ohio State University Cooperative Extension Service, Ohio Department of Agriculture and the Producers Livestock Association (PLA), a marketing co-operative based in Columbus, Ohio (Baldwin, 1980).

On the HAMS system third-party graders described hogs using a modified USDA system based on fat thickness and degree of muscling. HAMS refined the USDA carcass yield grades to predict percentage lean cuts off the hot carcass. This grading system was developed by Dr VanStavern of Ohio State

University and Dan Stillwell of AMS/USDA and tested using the grading and slaughter of live hogs. PLA personnel were trained by AMS to grade hogs during the pilot (Baldwin, 1980). Producers could sell by auction, with ascending or descending price, or by setting a firm offer price. The sales entry included information on the number of hogs for sale, their weight, grade, hair colour and location. Large producers marketed their hogs as lots on HAMS for direct despatch to the packer. Hogs from small producers were pooled into larger lots. Payment to the seller was guaranteed by the Producers Livestock Association (PLA), a co-operating market agent (Bell et al., 1983). Hogs were sold by two methods. In "firm offer" selling a farmer could offer more than fifty head at a fixed price, with the system open to offers from 8 am till 2 p.m. Alternatively hogs could be auctioned using either an English or Dutch auction. Most buyers and sellers were more familiar with English auctions, but the experiment sought to find if there were advantages in Dutch auctioning (Baldwin, 1980). The Dutch auction was soon discontinued (Toomey, 1981). In addition to providing the competing sales mechanisms the system also provided other relevant information, including market statistics and weather forecasts (Toomey, 1981).

HAMS was co-ordinated by an advisory committee of packers, farmers, order buyers marketing managers and academics: "*They accurately articulate the need of the industry and provide guidelines for the initiation of the experiment. Because of this input we believe more traders will buy and sell hogs on the experimental system*" (Baldwin, 1980). This board developed the trading rules for HAMS. On a turnover of 500,000 hogs per year it was estimated that selling costs would be \$2.10 per head, falling to \$1.16 per head on a throughput of 1.2M hogs, which would represent 50% of total Ohio hog production. In 1980 marketing costs in local markets were \$1.40 per head and \$1.95 in larger terminal markets. From this analysis it was believed that a throughput of 900,000 would be required to be competitive with local markets and 700,000 to be competitive with terminal markets (Baldwin, 1980).<sup>24</sup>

HAMS was supported with \$700,000 of USDA funding (Martin, 1985). An HP 3000 minicomputer was rented and installed at Ohio State University. Information and trades were communicated to 17 computer terminals at PLA yards, 10 farms and 20 packing plants using leased telephone lines (Baldwin, 1980). The system was expected to start operation in April/May 1980 but did not begin operation until November 10 1980 and operated for six months. It was only used by small producers and failed to achieve the throughput of 700,000 pigs per year which was needed for it to be economically viable.

In June 1981 John Stackhouse, Director of the Ohio Department of Agriculture, wrote to the "*staff and friends of HAMS*" announcing that HAMS would cease operating on June 12 1981 because of "*the current*

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<sup>24</sup> It is interesting that this analysis compares the electronic system to the squeezed live markets rather than the direct selling channel it was being established to challenge.

*economic conditions in the hog industry, and because all objectives as specified in the original 1978 proposal have been satisfied*". According to Bell et al (1983) the system failed because the volume of trade was not high enough to make electronic trading competitive relative to other sales methods and it was in competition with existing marketing channels. In a memorandum of July 24 1981 Henderson wrote: *"to date, there has been little interest expressed in translating the HAMS experiment into a commercial electronic hog marketing venture"*.

### **CATS**

A study for the USDA in 1977 had found that 70% of carcass meat sales were formula sales, in which the trading parties agreed to trade at a date in the future with the price determined by a formula derived from the wholesale carcass prices published in the Yellow Sheet, a private market reporting service of National Provisioner magazine (Bergland, 1979). The trades used to derive the Yellow Sheet and similar Meat Sheet reports represented less than 2% of carcass trades. The Secretary of Agriculture's report (Bergland, 1979) noted: *"There is concern that the current pricing system does not result in accurate price discovery in the short-run and that the thin market (a relatively small percentage of negotiated prices being used as the base for formula trades for the wholesale carcass beef market) creates a potential for price manipulation"*. The Secretary of Agriculture set up a Task Force to investigate these issues. In June 1995 the federal Secretary of Agriculture's Meat Pricing Task Force concluded that there was a need for the development and testing of an electronic market system for trading carcass meat supported by the USDA but owned and operated by a third party (USDA, 1979). The report cited the use of electronic marketing in the cotton sector and suggested that an electronic carcass meat market would reduce costs, allow faster transactions, create a more competitive market and improve dissemination of market information. However, the report also identified as barriers to the use of an electronic market the complexity of meat description, the lack of personal interaction and the reliability of the technology. General Electronic Information Services Company (GEISCO) and American Meat Exchange (AME), publishers of Meat Sheet, were developing a pilot system, CATS, which they planned to operate in 1979 (USDA, 1979). In 1980 the University of Illinois was funded by the USDA AMS to test and evaluate a national electronic meat trading system. Rather than develop a new system Illinois decided to use the GEISCO/AMS CATS system in their evaluation (Sarhan & Nelson, 1983).

The CATS system for the computerised marketing of wholesale meat was developed by the University of Illinois, with AMS/USDA and Illinois Department of Agriculture funding. CATS was pilot tested for trading beef, but did not attract the buyer or seller usage to make the system economically feasible. The CATS system listed offers and bids and reported actual transactions. Meat was described using an industry

meat-buying-guide system. Offers included details of country of origin, quantity, date available and offering price. Buyers then entered a “trading mode” on the system, allowing bilateral negotiation of terms, including premiums, discounts, special delivery requirements and the sale price. Sales prices and quantities were reported to all buyers and sellers (Bell et al., 1983). The system used a General Electronic timeshare computer service and only operated between June and November 1981 (Bell et al., 1983).

The University of Illinois carried out a evaluation of CATS (Sarhan & Nelson, 1983), surveying users and non-users of the system. This survey identified that non-participants “*did not participate due to a lack of awareness, a desire to observe others first, a belief that the system was unworkable or non-participation of trading partners*” .

### **CATTLEX**

Due to the close vertical integration between feedlots and packers, the greatest volume of cattle traded by auction in the United States was between the ranchers and the feedlots, who intensively fattened the cattle for slaughter. In Texas alone 6.2 M head of feeder cattle per year were passing through auction markets. There was a trend towards increasing direct sales, with the importance of large centralised markets decreasing (Sporleder, 1980). This was leading to the appearance of thin local markets with few active buyers and a lack of reliable price information. There was also a growing trend for stock to pass through several local markets being sold on by dealers leading to inefficiency in the channel. An electronic auction was seen as being a means of increasing market competition and transparency (Sporleder, 1980).

The CATTLEX system for computerised marketing of feeder cattle was developed at Texas A & M University by Thomas Sporleder. CATTLEX was supported by \$673,000 of USDA funds (Martin, 1985). The attitude of potential users of CATTLEX was assessed in a survey undertaken by Texas A&M University (Glazener & Sporleder, 1979). Glazener and Sporleder surveyed 4784 Texan producers of feeder cattle and gained a response rate of 40.7%. These were predominantly using auctions to sell their cattle to feed lots. Over 60% of the producers were satisfied with current marketing methods. Glazener and Sporleder concluded that “*the crucial condition for the success of computerised markets for feeder cattle is acceptance by producers*” and in particular persuading them to accept selling by description and the pooling of small lots into more economical larger lots. 60% of producers accepted the concept of grading, with 30% in strong agreement, but only 45 % were willing to pay for this service. 64% were willing for their stock to be pooled into larger lots, with 27% strongly in favour. Only 18% of producers were strongly supportive of both grading and pooling, but Glazener and Sporleder noted that 18% of the Texas output of

feeder cattle would be 1.4M head per year, concluding that the potential for a computerised spot market for feeder cattle in Texas was large (Glazener & Sporleder, 1979).

CATTLEX was overseen by an advisory group of industry representatives, TELMAG. On February 1<sup>st</sup> 1979 Glazener presented the preliminary results of the survey to the advisory group (TELMAG, 1979). Prior to this meeting it had been planned to include both an auction and a bid/offer mechanism for selling. It was decided that an offer system would be impractical because buyers would approach sellers directly to buy cattle advertised on the system. The imposition of a listing fee to discourage this behaviour by sellers was rejected because it was believed that it would discourage sellers *“because they are accustomed to paying a commission only for the sale of cattle, not just listing with no guarantee of sale.”* (TELMAG, 1979)

Cattle marketed through CATTLEX were first described by a third party grader, including number, sex, estimated weight, grade, location, delivery date, breed, age and condition. The USDA had defined standard descriptions of feeder cattle based on frame size (large, medium, small) and thickness (1, 2, 3) (Martin, 1985). During development of CATTLEX it was planned to adapt the USDA livestock classification system for use in the electronic system. On April 16<sup>th</sup> 1979 William Manley of the USDA wrote to Sporleder arguing that CATTLEX should follow the federal standards and not develop idiosyncratic standards: *“In our view, it is important that national standards be used as a descriptive tool for the project. Specific plans should be developed to assure uniform application of these grade terms. Because non-standard, regional terms (such as “Okies”) mean different things to different people, we may have some reservations as to their effectiveness nationally”*. The description was entered at terminals located across Texas and buyers could connect to access the description. The sale mechanism was to offer eight sale lots simultaneously for 16 minutes. Every two minutes the auction for one lot ended and another began. Buyers bid from computer terminals connected to the central computer at Texas A&M University. If the final highest bid exceeded the seller’s reserve price a sale was made. CATTLEX also included a forward-cash-contract option, which used an off-bid mechanism to sell cattle at a fixed price for future delivery (Bell et al., 1983). On CATTLEX stock offered for sale could be either “ranch” or “delivered”. Ranch cattle were described by third-party graders and offered in loads larger than a truck-load. Less than truck-load lots (under 40,000 lb.) were delivered to an assembly point where they were weighed and described (Sporleder, 1980).

At each remote user there was computer monitor and a printer. The description of lots comprised age, sex, weight, breed, weighing conditions, and grade, plus any additional information sellers believed relevant. Each buyer had a credit limit which was automatically monitored by the system to prevent a buyer

exceeding it. Sellers of ranch cattle could specify a delivery date up to 14 days after the lot was offered. Upon delivery the cattle were weighed and the buyer notified of the total price (Sporleder, 1980). The system allowed buyers to sort the catalogue by weight, sex, location, age, grade and lot size. Price differentials for inaccurate weight estimates were recalculated monthly from an analysis of the previous months sales. The scale of adjustments was distributed to buyers and sellers. Buyers and sellers could both watch the auction. CATTLEX provided users with an analysis of prices achieved and general relevant market information, such as current grain prices. Sporleder noted the importance of descriptions acceptable to buyers and sellers for a successful system (Sporleder, 1980).

CATTLEX began operation on September 3<sup>rd</sup> 1980 with an auction of two lots of cattle (Davis, 1980). According to Bell et al. (1983) CATTLEX was pilot tested in 1980-81 primarily to test the system developed for describing stock. Eighteen remote locations were connected to the central computer at Texas A&M University (11 auction markets, 3 feedlots and 4 order buyers) (Toomey, 1981). Although it was believed that cattle descriptions were not a barrier to its success, the cattlemen did not accept the system (Martin, 1985). Martin (1985) argued that this was because the system was too complex and led to the suspicion that the system was biased in the buyer's favour. Two specific objections noted by Martin were the lack of guarantees to the buyers that descriptions were accurate and that sellers put too high reserve prices on their stock, leading to 82% of the cattle offered being withdrawn unsold. CATTLEX never proceeded beyond its pilot operation. According to Purcell: *"They had so many computer and line requirements for that system, that made it very expensive"* (WP). In 1983 a Texas firm was modifying the system in preparation for a commercial test (Bell et al., 1983).

### ***Electronic Marketing Association***

Virginia Department of Agriculture had operated a telephone auction of feeder pigs, Tel-O-Auction, since 1964. Teleauction sales of feeder pigs, slaughter lambs and slaughter cattle rose to \$9M per year. According to Roy Davis, Director of Special Projects, Virginia Department of Agriculture and Commerce, their market data showed there were 130,000 slaughter cows coming from Virginia beef and dairy herds each year. These cattle were being sold in small lots in local markets, often bought by traders to be made up into larger lots for resale, leading to high marketing costs and a deterioration in quality (Davis, 1980). Unlike the United Kingdom or Australia, there is no tradition in the United States of auctions or other intermediaries between the feedlots and the packers (meat processors): *"It was of their own making - the large feed lot saying "I don't need anybody's assistance, I am big enough, I can fend for myself" - that is precisely what the packers wanted to hear because they are even bigger and stronger"* (WP). It was hoped that an electronic auction system could introduce competition into the trade with packers.

A project was undertaken by Virginia Department of Agriculture and the Virginia Polytechnic Institute and State University to assess the potential for a centralised slaughter cow market. An advisory committee was formed with representatives of cattlemen, dairymen, marketing associations, the Farm Bureau and market operators. Significantly this committee did not include representatives from the packers. This may have been due to the agenda of the system developers being to strengthen producers relative to packers, so packer involvement would have been seen as a conflict of interest. However, for the system to be successful it would have to be shaped to meet the needs of packers. The project was 50% funded by the USDA/AMS Marketing Improvement programme (Davis, 1980). In February and March 1979 a survey was made of 83 slaughter cattle producers and 20 North-eastern packers. The results of this survey were used in the design of the system. In April 1980 the packers were invited to a seminar in Washington DC at which they were found to be willing to participate in computerised slaughter cattle auctions, particularly for slaughter cows. Further meetings were held for Virginia producers and market operators between April and August 1980. There was some resistance to the concept of electronic auctions from order buyers, who bought in markets on behalf of packers, and from market operators, but producers reacted positively (Russell & Purcell, 1984).

Russell and Purcell (1980) surveyed cattle producers and packers during the design of the EMA electronic auction. From this survey they proposed a strategy for implementing the electronic market:

1. survey users to find areas of misunderstanding and address them through an educational programme;
2. Involve existing market operators: "Because of the need for assembly of small geographically dispersed offerings of slaughter cattle, the present auction markets will be essential to the success of the electronic system. They provide assembly facilities,, bring an element of credibility where producers are concerned and are a known entity to producers and packers. The pressure of competition between markets and the alternative of producer-owned assembly and weighing facilities will keep commission charges at reasonable levels and provide an incentive for present markets to become involved";
3. electronic marketing systems should be operated by a non-profit organisation representing producer groups and marketing agencies;
4. commissions must be competitive and costs low relative to auctions;
5. the weaknesses of "thin" markets should be stressed to producers;
6. establish a coalition of interests and involve them during development and implementation to overcome resistance to change.

The proposal developed was to assemble cows at auction markets or producer sites with facilities for unloading, weighing, grading and loading livestock. Full loads would be created and described using

USDA grades and offered for sale electronically for collection by the buyer. The electronic auction system was expected to increase the prices paid to producers, deliver a higher quality product to the packer, provide a competitive advantage for market operators, require less time for producers and allow the packer to schedule his kill (Davis, 1980).

In 1980 Virginia Tech and the Virginia Department of Agriculture were funded \$436,000 by AMS USDA to develop the computerised auction system to market lambs and slaughter cows. The system used computer terminals connected over telephone lines. Computer time was leased from a time-sharing remote access computer vendor. The Electronic Marketing Association (EMA) was founded in 1980 as a non-profit organisation to operate the system (Bell et al., 1983).

### *Technology*

Initially it was proposed to develop the Tel-O-Auction using more sophisticated telephone conferencing, but it was decided that the use of voice for bidding would be open to misunderstanding and that voice would be inefficient for communicating complex lot descriptions. It was found that a computer terminal could be used at the both auctioneer and bidders, with a main computer linking them. Using a time share central computer allowed the electronic auction to operate with lower line charges than the telephone auction due to the descriptions being transferred more quickly (Davis, 1980). The EMA system was a remote access time-sharing system utilising the services of the INFONET Division of Computer Sciences Corporation. The software had the capability to auction slaughter lambs, slaughter cows, fed cattle, feeder pigs and feeder cattle using either an English or Dutch auction (Russell & Purcell, 1984). It was rapidly found that the progressive English auction was more popular for buyers because it simulated the form of sales in the stockyards: *"The idea of using an initial Dutch auction and dropping until you get a progressive auction is a whole lot like what goes on in any livestock auction market and people were comfortable with it."* (WP) INFONET did the programming of the EMA system for no cost because they were interested in developing electronic markets: *"If we had had to pay for them we couldn't have gotten it as far along as we did."* (WP)

### *Operation of NEMA*

A sale description, including number of head, estimated or actual grade, estimated weight, condition, location and reserve price were entered into the computer. Buyers dialled an 800 number, connected their terminal and downloaded the catalogue prior to sale. At the specified auction time buyers connected again. The sale was a rising price auction with buyers given 20 seconds to make a higher bid, with bidding usually in increments of 25 cents per hundredweight (Bell et al., 1983).

The first attempted sale of slaughter cows using EMA in July 1980 was abandoned due to technical problems. Later in the month a sale was held which was technically successful, but while a number of buyers connected to the auction, it was only local buyers who were willing to bid. The prices achieved were not as high as was hoped. Further attempts to create a genuine market failed, with trials of dead-weight and live-weight selling. Local auction markets refused to allow their yards to be used for aggregating and weighing lots and “*opposition from order buyers was becoming severe.*” (Russell & Purcell, 1984).

In a follow-up survey of system users dissatisfaction was expressed by packers to the carcass grading and buying live-weight. Russell and Purcell suspected that order buyers were influencing packers not to use the system, but the packers were unwilling to admit this because it would have been illegal under competition law (Russell & Purcell, 1984).

In summary, Russell and Purcell saw five reasons for the failure of cattle sales:

1. the hardware and software problems in the first sale;
2. cattle were being grouped into lots too small for the packers;
3. sale times were too late;
4. buyers were unwilling to support the system;
5. order buyer pressure on auction market operators and packers to stop them using the system.

Russell and Purcell noted that while 1, 2 and 3 could be overcome through adapting the system, overcoming 4 and 5 would be more difficult. One of the lessons they drew was the importance of the active involvement of a producer organisation to promote, co-ordinate and oversee sales. Most crucially Purcell saw the concerted resistance of agents as the barrier which stopped the cull cow sales operating successfully. According to Purcell, one individual who was involved through agents in the majority of cull cow sales across the States applied pressure to the packers, threatening that if they started buying over the electronic system they would not get stock from him. Purcell heard this third-hand but was not able to get packers to admit it. Additionally, Purcell suggested that another barrier might have been the difficulty in adequately describing a cull cow (WP).

### ***Lambs***

Following the failure of cull cow sales EMA redirected their efforts to the selling of slaughter lambs. The selling of slaughter lambs on EMA appeared attractive because in the United States, except for Texas, lambs are reared in small flocks and there is little competition amongst buyers for the small lots offered.

EMA sought to offer truck-load sized lots to a range of potential purchasers. Sheep breeders' co-operatives took on the role of consolidating sheep from producers into truck-load lots at centres for electronic sale.

In December 1979 Eastern Lamb Producers Cooperative (EPLC) decided to use EMA's system for slaughter lamb sales. EPLC had been holding teleauction sales between May and September since May 1971. Buyers who used the teleauction were invited to a seminar in April 1980 in Washington D. C, to inform them about the electronic auction. The terminal was demonstrated to show that buyers could bid from anywhere by telephone, then they gave the buyers the terminals to take home on six months free trial. All the buyers present took up the offer to take a terminal away. On May 30 1980 the first computerised lamb sale was held of three lots, with both the technology and the prices achieved meeting EPLC's expectations. EPLC sold lambs from Virginia, Kentucky, North Carolina, Ohio, Tennessee, Vermont and West Virginia (Russell & Purcell, 1984). In 1981 Equity Co-operative Livestock Sales of Baraboo, Wisconsin, also started using the system, trading as Corn Belt Lamb. EMA's lamb auctions increased to three auctions per week by 1983 organised through the Corn Belt Lamb and Eastern Lamb Producers Cooperative. The variable costs of the 32 ELPC slaughter lamb sales in 1980-81, with an average of eight terminals on-line and three lots per sale, were \$102. The sales took an average of 14 minutes. The variable cost per head was on average 16 cents, with a range between 8 and 43 cents. In 1981 Corn Belt Lamb, when Corn Belt Lamb started using the system for their larger sales, Bell et al. (1983) forecast the variable cost would be 5¢ per head for a 2000 head sale.

To evaluate the system's use for lamb selling a survey was carried out of 20 producers and 8 buyers. The main problem identified was inconsistency of grading, with EPLC occasionally having to compensate buyers for inaccurate grading (Russell & Purcell, 1984). Russell and Purcell viewed the lamb auction as a success, relative to the failed cull cow sales, due to it being well-managed by EPLC, the willingness of buyers to use the system and the previous experience of participants of teleauctioning. In 1983 200,000 lambs were marketed using the system (Martin, 1985). Four areas of improvement were identified: more accurate and consistent grading, more generous compensations for deviations from the par Blue 0 grade, greater flexibility for large scale producers and an educational effort to increase awareness amongst EPLC members. All respondents surveyed either preferred the electronic auction to the previous teleauction or were indifferent to the change (Russell & Purcell, 1984). Purcell argues that system worked because of the involvement of the lamb co-operatives who wanted to see it work, and there being no need to own or lease a mainframe computer (WP).

According to Davis (1980): "The successful operation of an electronic marketing system is totally dependent on the ability to apply descriptive terminology accurately and in such a way that the packer can

bid with confidence". However, when Martin, an English auctioneer on a study tour of North America, viewed the system in 1984 the problems of accurate description was seen as being the main concern for lamb buyers. In particular Martin reported a buyer criticising the variability of quality and conformation within lots which had been put together from several producers to make up full trailer loads (Martin, 1985).

### ***Change in the Ownership of NEMA***

EMA (Electronic Marketing Association) was a non-profit producer controlled entity incorporated in February 1980. The EMA system was operated by Virginia University for six months (Bell et al., 1980). The University of Virginia were prime movers of the system, responsible for developing the system and hiring an ex-graduate student of Purcell and selecting other staff. The project was funded with sufficient funds to operate the system for six months. Effectively the costs of the project were initially borne 100% by the USDA grant. The University of Virginia did not intend to support EMA in the long-term, expecting it to transfer to the private sector and be self-supporting. The National Live Stock Producers Association took over EMA in October 1982, renaming it the National Electronic Marketing Association (NEMA) (Bell et al., 1983). According to Purcell, the board of NEMA was made up of people who did not fully understand electronic marketing. At that time only two people were employed, one running the system and maintaining the office, and another working in the field, talking to producers and trying to extend it to slaughter hogs. Purcell believed it would have taken two years of losses to make the system profitable. However, a point was reached where additional capital was required and the NLPA refused to support it (WP). In 1983, NLPA became disenchanted with NEMA and sold it to one of their affiliates, Equity of Baraboo, Wisconsin, the operators of the Corn Belt Lamb auctions, and to Jim Wideman, from Ontario, Canada, who renamed it NEMI (National Electronic Marketing Inc.). The new owners immediately dismissed both of the people that worked on the system and removed Wayne Purcell from the board of directors.

### **Comparison of Electronic Systems in United States**

In 1984 six electronic agricultural commodity markets had existed in the United States of which only three were still operational: Telcot, ECI and NEMI.

**Table 2: Electronic Agricultural Commodity Markets in United States<sup>25</sup>**

	Telcot	ECI	NEMA	HAMS	CATTLEX	CATS
Commodity traded	Cotton	Eggs	Lambs, hogs, feeder cattle	Hogs	Feeder cattle	Meat
Operating Organisation	Plains Cotton Cooperative Association	Egg Clearinghouse Inc.	National Electronic Marketing Assoc., Christiansburg VA	Ohio State Univ. & Producers Livestock Assn	Texas A&M	American Meat Exchange, Elmhurst, IL
R & D Support			Virginia Tech Univ.; Computer Services Corp.	Ohio State Univ.	Texas A&M Univ.	University of Illinois; General Electronic Information Services Co.
Purpose	Commercial	Commercial	Pilot & commercial	Pilot	Pilot	Pilot
Source of Capital	Private	Predominantly private	Public & Private	Predominantly public	Public	Predominantly private
Operational Period	Since 1975	Since 1978 <sup>26</sup>	Since 1980	Nov. 80 - June 81	Sep. 80 - Nov. 81	Jun. - Nov. 81
Communication System	Leased wire	Inbound WATS	Utility computer network	Leased wire, dial-in	Leased wire	Utility computer network
Number of terminals	405	56	45	47	29	16
Market Area: Sellers	Texas, Oklahoma	National	Mid South, Corn Belt, Great Plains	Ohio, Indiana	Texas	National
Market Area: Buyers	National	National	National	Eastern states	Texas	National
Type of Pricing System	Sealed bid, firm offer	Double auction	English auction	English or Dutch auction	English auction	Private negotiation
Approximate sales volume	1.5 M bales per year	700,000 cases per year	750,000 head per year	180,000 head per year	2,400 head	95 carloads

<sup>25</sup> From Henderson, 1984.

<sup>26</sup> Operated 72 - 78 as telephone clearing house.

Of these systems, only the oldest, Telcot, was entirely privately funded. NEMA, HAMS, CATTLEX and CATS were all supported by the USDA AMS electronic markets initiative. All six markets used computer terminals giving traders direct access. Telcot, HAMS and CATTLEX used leased telephone lines, NEMA and CATS used utility computer networks and ECI used WATS. The systems used a wide range of price discovery mechanisms: CATS did not use competitive bidding, providing instead a mechanism for private negotiation, while ECI used progressive bidding and regressive offering by buyers and sellers. In their overview Bell et al. (1983) noted that the diversity of technical standards, and in particular the hardware requirements, acted as a barrier to the growth of the systems, restricting compatibility and creating a cost barrier to participation. The lack of success of the USDA funded projects naturally led their supporters to question why the initial predictions had been found optimistic. *“The lack of resounding commercial success raises the question, is this performance an unrealistic expectation or is this a concept whose time is yet to come?”* (Henderson, 1984).

Bell et al. (1983) identified five lessons from the experience of electronic marketing prior to 1983:

1. Systems should be kept as simple as possible at first and plan so the system can be expanded;
2. Dedicated phone lines are prohibitively expensive in many situations, especially for new ventures where volume is limited;
3. Software development can be expensive, so organisations considering electronic marketing should strive to take full advantage of existing electronic marketing systems;
4. Time-sharing arrangements for both the host computer and the communication network should be explored because there appear to be significant cost advantages where the sales volume is limited;
5. Technology should continue to lower the real cost of electronic marketing, making it more cost-feasible.

Bell et al. (1983) concluded that there was a danger in looking at the costs associated with computer-based marketing in isolation because the pricing benefits to sellers may be more important than cost.

Based on the experience of the USDA funded pilots, Schrader (1984), a professor of Agricultural Economics at Purdue University, hypothesised that electronic marketing would result in prices favourable to farmers and in prices which would more accurately reflect the “true” equilibrium price. Schrader recognised the difficulties of drawing definitive conclusions because of the difficulty of knowing the “true” equilibrium price. Schrader found evidence that HAMS, NEMA and CATTLEX were giving prices higher than were being achieved in comparable conventional markets. Schrader suggested that this apparent price advantage may not have been due to the efficiency of price discovery in electronic markets, but alternatively could have been because sellers were demanding more to sell electronically with traders

preferring to trade low prices in private, and that there may be overbidding by buyers seeking to gain experience of the novel system. Schrader' review found evidence that electronic market prices led the orthodox markets for ECI and NEMA, but the significance of this lead seemed to diminish with time (Schrader, 1984). Schrader noted that buyers had little incentive to encourage the formation of an electronic market, concluding: *"if the use of electronic trading does result in a shift in market power from the concentrated side to the less concentrated side of the market, the concentrated is not likely to be an enthusiastic supporter of the change. Thus the initiative for change probably must come from the powerless side - the farmer. In the case of Telcot, a farmer co-operative initiated the change. ECI was started primarily because of producer dissatisfaction with pricing"*. At the same symposium Purcell (1984) noted: *"we are all groping for the reasons for the lack of more widespread acceptance [of electronic markets]. An important reason could be our inability to bridge effectively the perceptual gap between the academic and private sectors"*. Purcell concluded: *"Conceptualisation of what looks like a more efficient and more responsive system is apparently not enough. There are barriers to acceptance"*. When asked his views on the USDA projects, Purcell argued that the projects had not failed, claiming that they explored the potential for electronic markets, that people who came to the seminars on electronic marketing learnt what they could do electronically and it stimulated interest in the use of computer networks. He claimed that the Texas and Ohio systems were held back because they required substantial mainframe computers with requirements for dedicated lines to terminals. Virginia University were involved in a following USDA funded project to set up a national electronic grain marketing system: *"We were on the verge on two or three times of having groups of private sector people pick that up and run with it"* (WP). When developing a grain auction, Purcell did not intend to use an auction. It was built as a bid-offer system with the opportunity for bilateral negotiation over the network: *"the computer at your desk would literally ring a bell when someone was countering your offer"*. However, it was decided this mechanism would be too time consuming to auction either grain or livestock.

### **Satellite Selling**

While USDA projects were developing computer-based electronic markets for livestock, entrepreneurs were having more success operating video auctions to provide ranchers with a competitive market for feeder cattle. Of these video auctions the most successful has been the Superior Livestock Auction. Jim Odle took over the operation of two livestock markets in Greeley and Brush, Colorado, in 1965 and 1970. In the United States the largest competitive market for cattle exists between the ranches which breed the cattle and the intensive feedlots which fatten the cattle for sale to the packers. The relationships between feedlots and packers are generally negotiated on long-term supply contracts. Prior to the emergence of

video auctions, sellers of feeder cattle had two alternatives. They could either sell their cattle directly to the feedlots or transport them to a local livestock auction. As was identified by Henderson et al., the proportion of cattle being traded through direct sales was increasing, with fears that this was increasing the power of the major feedlot corporations relative to the ranchers. To overcome this weakness some producers started organising their own telephone sales in which they auctioned their own stock using a conference telephone call to several feedlots. To create a more efficient market for feeder cattle, in 1980 Odle established a video auction for feeder cattle, Cumberland Video Auction. Ranchers with stock for sale contacted a representative of the system who would visit the ranch and video the cattle. Originally buyers would come to a central location in Denver or Salt Lake City at an announced time and the lots were auctioned with the buyers seeing the stock on video. The geographical spread of this system was extended by displaying the videos simultaneously in four cities and linking the centres to a central auctioneer by telephone. In 1982 Buddy Jeffers had taken over the livestock market in Amarillo, Texas, and in 1986 started operating the first satellite auction in Texas. The use of satellite television removed the need for buyers to travel to a central location, instead they could stay at home and watch the cattle being displayed on their home television and bid by telephoning in to the central auction location. Most of the buyers were in rural locations, so there was a high level of satellite viewing capability prior to the system being launched. In 1987 Jeffers and Odle merged their companies to create Superior Livestock Auction. Superior takes over a function room in a hotel and installs the video cameras for transmitting the auction and the telephones for linking to buyers. The sale uses a traditional livestock auctioneer. In the United States auctioneers are generally self-employed and travel from sale to sale, each developing their own idiosyncratic style of chanting and the most successful becoming famous in the industry. Compared to electronic auctions the use of a live auctioneer overcomes the lack of atmosphere in remote selling. Cassady ( 1967, p 117) noted that the purpose of chanting in auctions is to fill the time between bids, disguising any loss of momentum as bids dry up.

Superior's sales last all day, selling stock from Canada to Mexico, and a relay of well known auctioneers are used. In front of the auctioneers sit bid relayers at desks connected to buyers by telephone. Beyond them sit sellers who have come to the auction to see their stock sold and buyers. While neither buyers nor sellers gain anything in the auction from attendance, the sale is used as a basis for ranchers and buying agents to meet up and take their family to a city for the weekend. This social foundation for the sale is fostered by holding the sales on Saturdays, but the reason for Saturday sales is that it is believed that on a Saturday the feedlot buyers will have the time to drop in and out of the sale as it proceeds. The bid relayers are independent contractors who source stock for the system. For these contractors attendance at the sale allows them to be seen on the satellite broadcast, helping their recognition with their ranchers and

also providing an opportunity for socialising with other contractors from across the country. Superior employ 20 salaried staff, but have a network of 350 independent contractors in the United States, 40 in Canada and 10 in Mexico.

The Superior auction operates with a correction ("slide"), which reduces the price per CWT for stock weighing more than described. There is no correction for underweight stock because they are more valuable per pound. Often lots are described as allowing the purchaser to sort a number from a larger herd. A Superior representative is always present at the collection and sorting of stock to ensure that the stock supplied are those initially videoed. Lots are generally based on full semi (i.e. articulated trailer) loads of 50,000 lb. When loads are less there are freight adjustments built into the pricing to keep the prices relatively independent of source location. These adjustments are however independent of the actual distance the buyer is from the stock and therefore what the cost penalty of a partial load is for that seller.

In the observed sale a quarter of lots were withdrawn unsold. According to Odle this was because prices had been falling and sellers were basing their expectations on the last price their stock made. In withdrawing a lot the seller only forfeited the \$2 consignment fee, which on 100 head would be less than the cost of advertising the stock in a trade journal. Superior had had problems with sellers using the system to advertise their stock then, after withdrawing their stock, seeking to sell directly. Odle claimed that this was a major reason for the failure of early video auctions, many of whom did not charge a fee for non-sales, but that Superior's network of local representatives, who lose commission from this behaviour, would identify sellers abusing the system in this way.

Existing auctions had been very hostile to the formation of video auctions but Superior "*had enough rapport and enough strength to get top dollars*" (J Odle). Although the feedlots which buy the cattle are in agricultural terms large operations, they are not as concentrated as packers. For feedlots the video auctions provided a low cost means of sourcing livestock from outwith their areas. In 1995 direct sales and livestock markets shared 80% of cattle sales. Superior were selling approximately 1M cattle per year, with the other two satellite systems selling 200,000. Superior's commission was 2%, with a minimum fee of \$7.25 per head. Where lots are removed because they had not made their reserve price there was a consignment fee of \$2 per head paid by the seller.

Four video auction systems have operated in the United States: Superior Livestock Auctions, Satellite Cattle Exchange Ltd, Western Video Market and Producers' Video Auction. The last of these was formed by the National Livestock Producers Association, the national association of producer co-operatives, many of whom were live market operators. The Producers Video Auction was run from Texas because of the expertise of staff in that state, with all the member agencies operating as sales representatives who went

out with video cameras to video stock. Producers Video auction was started in 1987 operating through established co-operative livestock markets who were members of the National Livestock Producers Association to challenge Superior's position as the dominant video auction based on "the same concept". However the commitment of these established auctioneers was low, with many taking it on as a defensive move. The Producers Video Auction was less successful than expected and ceased trading in 1993 (Hansen, 1992).

### **Canadian Electronic Auctions**

While the impetus for the development of electronic markets, except Telcot, in the United States came from government, in Canada the foundations for electronic marketing were laid by the monopoly producer marketing organisations for pigs seeing a benefit in electronic marketing. Prior to the electronic system hogs were being shipped by producers direct to packers, with the market prices set by the prices achieved for the sale of a small number of hogs through the government supervised auction in Toronto. For most producers there was little scope to negotiate over prices. The Ontario Hog Producers Marketing Board was established in 1945 to create a market more sympathetic to producers, which in 1955 became the Ontario Hog Producers Cooperative, a legal selling monopoly. The Agricultural Products Marketing Act allowed the formation of producer marketing boards with the power to ensure that all produce went through their procedures. The Ontario Hog Producers Cooperative sold hogs to the packers by telephone. The telephone market was believed to be distorted by collusion between packers and the Ontario provincial government was eager to see a genuine auction. The Ontario Department of Agriculture insisted that the system must be open to all packers, that hogs must be sold to the highest bidder and that records must be kept of all transactions (Koch, 1961).

The Ontario teletype auction was developed by Bell Telephone Company of Canada at the instigation of the Ontario Hog Producers Cooperative (Koch, 1961). The system, called Simultaneous Swine Offering With Written Buyer Notification (SSOWWBI), took three years to develop and became operational in April 1961. At the heart of the system was an electronic broadcast repeater to broadcast the auction over telephone lines to a network of teletype machines. The repeater was two feet high by two feet deep and seven feet high containing 12,000 soldered connections, 85 vacuum tubes and 1200 diodes. White lights on the repeater showed which buyers were in contact and red lights showed the successful bidder. To create a Dutch auction a punched tape was used in the auctioneer's teletype to broadcast a falling sequence of prices to teletype machines at the buyers' offices. Each lot took less than a minute to sell, with the system handling over 40,000 head per week. The total cost of operating the system was \$3000 per month which was met through charging a commission of 1.5 cents per head (Koch, 1961). Packers contacted by

Koch were generally happy with the transition to a teletype auction, but did not like the increased price volatility that it led to.

The system started operating in spring 1961 after 3 years development. The Hog Producers Marketing Board operated 45 collecting points across the province. Pigs were delivered by producers to these yards where they were weighed and their details passed to the central sales office. The pigs were offered to 11 potential purchasers using teletype machines linked by phone lines. Hogs were sold by grade and yield with bids per hundredweight dead-weight. Normal Canadian practice is to sell on a dead-weight basis, which contrasts with the United States system of live-weight selling. The pigs are offered on the basis of the Canadian weight and grade classification system, which uses a loin fat measurement with a range of deductions in price for exceeding the optimum fat level and variations from optimum carcass weight. Bids were made on the basis that carcasses would be graded grade A - if they were graded B the price was reduced by \$1 per hundredweight. Before the lot was offered, the operator of the central teletype machine would alert each buyer using a bell. They were supplied with details of the lots, including number, location and lot number. The auction was a Dutch auction with the initial offer at 50 cents per hundred weight above the expected price. The price then fell in increments of 5 cents per hundredweight until either a bid was made or the lot reached its reserve price. A light flashed at each terminal to make bidders aware that the lot had been sold, but they did not learn who it had been sold to (Cassady, 1967, 200). Once sold the pigs were transported from the collection yard direct to the purchaser. At slaughter the carcasses were graded and weighed by government employees and the price calculated.

Martin (1985) observed that a similar pig marketing system had been introduced in Alberta, but this system had been resisted by the packers (meat processors), with packers paying "huge fines" for manipulating the teletype auction due to there being only two significant buyers. This led to the packers not being told the location of the pigs on offer, and the bidder offering the largest amount being allowed to choose which pigs they uplifted.

During 1981 the Ontario Cattlemen's Association proposed the use of an electronic auction system for slaughter cattle. A study was undertaken to assess the attitudes of market participants to an electronic system. To do this the EMA system was demonstrated by Roy Meek of EMA to producers, packers and purchase agents in Ontario, whose attitudes were then surveyed (Ceschi-Smith, Martin & Smith, 1982). The survey found producers dissatisfied with all the currently available marketing routes. The majority of producers and packers were willing to accept third-party grading and the majority of commission agents were willing to provide cattle descriptions. Packers indicated that they would use the system if there was a high volume of stock and producers were willing to use the system if costs were no higher than for existing

marketing channels (Ceschi-Smith, Martin & Smith, 1982). The Ceschi-Smith survey concluded that the viability of an electronic system would depend upon the integrity of market participants. At demonstrations it was seen that the system could be abused by inaccurate descriptions and low quality cattle being substituted for graded ones. Also the system would suffer if reserve prices were set too high or producers were unhappy with the weights and grades of their carcasses (Ceschi-Smith, Martin & Smith, 1982).

In 1972 J Wideman and two others bought the Waterloo stockyard, taking equal shares. In 1973, Kitchener Stock Yards owned by 5 shareholders had to move out of Kitchener. The two merged to form Kitchener Waterloo Stockyards, with 8 equal shareholders. Wideman became assistant manager and a new facility was built at Waterloo. In 1976 the company was renamed the Ontario Livestock Exchange (OLEX). In 1986 Ontario Livestock Exchange merged with Mercedes Group, which is also involved in nursing homes, restaurants and tourism. Wideman's background was not directly in agriculture, having graduated in psychology and sociology. OLEX had experience of remote selling because their stockyard was one of the most significant collecting points of hogs for the Ontario Pork Producers Marketing Board system and they had been involved in video sales with the Clyde stockyard in Alberta. In the 1980s OLEX's live auction had been losing its share of the slaughter cattle trade as the meat processors increasingly bought direct from producers. Wideman saw electronic auctioning as a means of halting this decline. He started looking at electronic auctions in 1978, seeking a mechanism for competitive price discovery, believing that the traditional live auction was inefficient and *"not terribly good for livestock"* (JW).

To assess the electronic auction systems in use at that time Wideman visited Dr T Sporleder at Texas A&M University who was responsible for CATTLEX. According to Wideman CATTLEX was too complex and the auction mechanism was too different from a live auction. He visited two auction markets who had computer terminals linked to CATTLEX, but found them unwilling to market the system actively: *"They took the system for defensive reasons to keep competitors out, but their main goal was to continue to have their live auctions."* (JW) Wideman also visited NEMA in Christiansburg, Virginia where he saw them auctioning lambs electronically. Wideman was more impressed with the NEMA system because it was less complex, ran on a bureau computer and simulated the traditional sequential auction, and so would be more familiar to buyers. Wideman returned to Ontario keen to develop an electronic market in Ontario similar to the NEMA system. The Ontario Cattlemen's Association approached Wideman and they found that they shared an interest in electronic marketing. OLEX joined with eight other Canadian auction companies to pilot an electronic cattle auction in Ontario. This trial lasted six months in late 1981 and early 1982. The trial used the NEMI software and their bureau service. After six months Ontario Cattlemen's Association decided to terminate the experiment. Ontario Livestock Exchange had put 80% of the cattle on to the system, with the other auctioneers being seen by Wideman as being involved in the

pilot for defensive reasons. OLEX and another auction firm offered to take over running the electronic auction. The test demonstrated to Wideman the feasibility of electronic selling but had not proved that it was commercially viable (JW).

OLEX hired a programmer to develop their own electronic marketing system. On functionality the system was specified to replicate the NEMI system: "*basically it didn't change dramatically from the Virginia system, other than it was more efficient in terms of data handling*" (JW). Wideman wanted the electronic auction to be a real-time sequential auction because the bidder would know immediately whether he had purchased the lot, rather than have to wait, as in bid-offer systems. Also, Wideman wanted the auction to ensure that individual producers could be identified to buyers, and thereby encouraged to improve their quality, so the pooling of stock into consolidated lots was not included (JW).

In May 1983 OLEX started selling cattle electronically using their own system (Martin, 1985), adding feeder pigs in 1985. The OLEX system ran on a DEC computer connecting to bidders by modems using the public data network. The OLEX system was therefore very similar to the NEMA one, except that it ran on a DEC minicomputer rather than a bureau. This computer was also used by OLEX for stockyard administration. The software was sold to the renamed Ontario Pork Producers Marketing Board to replace the teletype system, who sell all the 4.5M slaughter hogs produced in Ontario electronically.

In 1984 Martin described the operation of the OLEX system while on a study tour of North America (Martin, 1985). There were fifteen packers who used the system. On the morning of the sale a sales catalogue was distributed electronically, giving details of the seller, the number of cattle, sex, estimated live weights, estimated carcass weights and grades. Bids were on the basis that carcasses were top grade, A1. The system used a system of specified deductions for carcasses which when slaughtered were classed at lower grades. The lots were offered by English auction, with bidders using their computers to bid in standard increments (usually 25 cents/100 lb.). Only the auctioneer knew the identity of bidders. In 1985 weekly sales averaged 1000 head, with J Wideman estimating that 50% of these would otherwise have by-passed the auction and been sold direct. OLEX charges varied depending on the amount of effort required by the auctioneers. Where the farm was visited to describe the stock the charge was \$5 per head, but increasingly cattle were being described by the seller, with charges down to \$2.50 per head. This represented a commission of only 0.5% for a 100 lb. carcass selling for \$150 (Martin, 1985).

In 1985 J Wideman franchised the OLEX system across Canada as TEAM (The Electronic Auction Market). In addition to OLEX, covering Ontario, the franchisees were Calgary Stockyards, covering British Columbia and Alberta, and Saskatchewan Wheatpool, covering Manitoba and Saskatchewan. In Ontario, the Ontario Livestock Exchange did not franchise to any other operators. In 1988 OLEX

marketed 99,127 slaughter cattle - 20% of the Ontario total - and 116,193 store pigs, with 4.5 million finished pigs marketed on the system by the Ontario Pork Producers Marketing Board. For 1997 Wideman estimated that OLEX would sell 80,000 head of cattle plus 200,000 feeder hogs, Calgary Stockyards would sell 200,000 cattle and Ontario Pork Producers would sell 3,600,000 finished hogs (JW). Electronic trade in Ontario represents 15% of slaughter cattle and 5% of feeder pigs.

In 1984 Wideman was visited twice by people developing an electronic livestock market in Australia. Wideman hoped to sell them a licence to use the OLEX systems but they went on to develop CALM independently: *“they wrote it in the same language, wrote it for DEC equipment, all the same as ours”* (JW). In 1987 Aberdeen and Northern Marts from Scotland approached OLEX, having read about the system in a magazine article. OLEX sold ANM the license to use the system to sell agricultural products in the United Kingdom and an option open for two years to purchase a license for the rest of Europe, which was not taken up.

## ***NEMI II***

In mid-1983 NEMA was selling sheep and some feeder cattle in the United States. Wideman attended NEMA's annual meeting with the aim of buying a stake in the firm to get *“a window on electronic marketing in the States.”* Wideman knew that the National Livestock Producers were not committed to NEMA and he aimed to gain a 51% controlling interest. However, Equity Livestock of Baraboo Wisconsin and Texas Livestock Producers, two livestock co-operatives affiliated to National Livestock Producers were also interested in buying a share in NEMI. Wideman, Equity and Texas each took a 33% stake in NEMA and renamed it NEMI (National Electronic Marketing Inc.). At this point OLEX had their own OLEX system and Wideman, their general manager, owned 33% of NEMI which was using the software developed by NEMA funded by the USDA. Wideman thought the NEMI system *“very clumsy”* running on a *“huge computer on the west coast and offered as a bureau service”*. NEMI continued to operate a bureau service for Equity and Texas Livestock. In 1985 Wideman was approached by John Wilson, a friend who worked for the Ontario software developers WATCOM, who proposed with a partner Rob Veitch to rewrite the NEMI system as a DOS program in exchange for a share of NEMI. The new software ran on a personal computer rather than on a DEC, as was the case with OLEX. The United States owners were bought out and NEMI was reincorporated as a Canadian company, with ownership shared equally between Wideman, Wilson and Veitch. NEMI operated a 486 personal computer based in Canada, but no Canadian markets used the system. The NEMI system became profitable, running sheep and pig auctions for United States co-operatives (JW).

In 1991 NEMI sold a licence for their system to APEX, a United Kingdom rival to ANM. Wideman discussed this with ANM, the United Kingdom operators of the OLEX system, who unsurprisingly “*had some concerns*”. Wideman claims to have informed ANM that Ontario operated two systems: “*The NEMI system would not at the time I sold the OLEX system have been the one for ANM and OLEX only owned 33% of NEMI.*” (JW) The other 66% of NEMI was owned by Canadians who developed the system, who Wideman implied vetoed the sale of NEMI to ANM (JW). In September 1994 Wideman sold a licence for NEMI to Vleissentraal, a South African co-operative with markets across South Africa, after competition with the Australian CALM system. Wideman claimed Vleissentraal chose the NEMI system because it was a real time interactive auction. The South African system is called AGMEX (Agricultural Marketing Exchange) and was launched in March 1995 to sell feeder cattle and maize from August 1995 and, it was intended, carcasses from September 1995. In September 1995 Wideman was negotiating to sell a licence for the NEMI system in Argentina (JW). Both OLEX and NEMI sold the systems as outright sales of the rights to use the software on one host computer to sell defined commodities across a defined area. They do not take commission from the operators on electronic sales in the UK or South Africa. (JW)

The OLEX and NEMI systems both emulate the physical auctions in Canada and the United States. The auctioneer can set the initial price decrements, the increments and the time allowed to bid. The auctioneer can also decide whether bidders are anonymous to other potential bidders “*based on local experience and local politics*”. Numbering the successful bidders allows bidders to assess the number of active buyers. In Canadian slaughter cattle sales all buyers are informed who bought each lot at the end of the sale. (JW)

In Western Canada the electronic auction was 99% live weight, while in Ontario it was almost totally dead weight. In Ontario buyers and sellers were used to dead-weight selling, even though physical auctions were live-weight: “*Part of our marketing strategy was to bring competitive bidding into the dead-weight market because it didn't exist before*” (JW). In Western Canada the system was used by large feed lots who were not comfortable selling on a dead weight basis. Selling dead-weight it was easier to include premiums and discounts for grading into the system, but in Western Canada the descriptions were sufficiently accurate for the buyers to buy live weight. In Ontario, 75% of cattle would originally have been seen by OLEX staff or an agent, but by 1995 70% of cattle were being described by the producers: “*As time has evolved, one of the exciting spin-offs for me with electronic marketing, is the extent to which the knowledge base of the producer has expanded...*” (JW).

The OLEX description form gives an estimate of live weight, estimate of carcass weight, anticipated grades for conformation and descriptive information. Wideman sees the Canadian classification system as inferior to the European EURO grid: “*The EURO grid is superior in terms of being able to describe the*

*livestock. I wish we had a grid like that.*" The Canadian grid is A1, A2, A3, A4, which combines fat and conformation, but is more focused on fat levels. Wideman claimed that: *"the assessment is key....its the determination of who needs to do that, but the assessment process is absolutely key, no question about that. If a large seller does poor assessments the buyer will take a poor view when other lots are offered, so producers have an incentive to grade accurately"* (JW).

The OLEX electronic auction produced price reports. In 1993 OLEX stopped distributing price reports immediately after the auction, and started reporting six days later. This was because the electronic auction had become the price setter for dead-weight sales by private treaty in the province: *"Immediately following the first sale we did that we had the phones ringing off the hook, packers calling."* The Ontario Cattlemen's Association report the details of private treaty sales and dead-weight sales, and Wideman claimed that electronic auction outperformed private treaty sales by \$1 to \$3 (CA) per CWT. In Ontario commission on cattle is paid by seller at 6 dollars per head, which is approximately 0.75%. On pigs commission is split between producer and buyer, because this has been traditional in Ontario for pigs, at about 1%(JW).

## **EQUITY**

In the United States the principal remaining user of the NEMI system is Equity Livestock. Equity Livestock was established in 1920 as a producers' co-operative based at a terminal market in Milwaukee, Wisconsin. It is the largest agricultural co-operative in the United States . In the 40s and 50s Equity moved from the Milwaukee terminal market to operate 10 local markets, each operating daily sales for a range of livestock, all in Wisconsin except for one at Waukon in north eastern Iowa. Equity see the next move as being away from the live market: *"We think that our facilities one day will have a staff of people that will weigh, sort, grade, and put together load-like units. The actual auction, the price discovery, will happen electronically. It is efficient. The packer, rather than putting his person in a car, salary, expenses, he can merely tune in at the allotted time and bid on these animals."* (SG)

Equity were briefly part-owners of NEMI when NLPA sold it. Equity have used the NEMI system since 1981, working with the second generation system developed by Wideman since 1983. Equity use the AT&T data network to handle the connections between buyers across the country who dial up local toll-free 800 numbers. Scott Gardner, Equity vice-president marketing, argued that the use of electronic marketing was not dependent on the technology: *"It is only as good as the people who work on it."*

Equity had been sourcing stock for the Producers Video Auction, but saw electronic auctioning as a more viable alternative. According to Gardner of Equity: *"The cost burden of satellite is a problem. Even if you*

*have the best equipment and the best reps, you are the best editing department and the most efficient in time management, the cost is just terrible, and you still only get a satisfactory view of the livestock. So we find our producer saying, "Okay, I am watching a video auction. I feel more comfortable with it because I am actually seeing the livestock I am bidding on. However, I have to make adjustments in my mind to know the cattle are running uphill, the cattle are running downhill, the photographer is standing on a gatepost." (SG).*

For Gardner, the vice president marketing, in electronic marketing the sale is based on *"a good sales rep that is using standardised description terms to describe the livestock."* Descriptions are based on the standardised USDA live description terms. Equity sell lambs live-weight, whereas other agents, for example Eastern Lamb in Virginia, sell the meat using USDA carcass standards. On the Equity cattle sales the bidding is on a dead-weight basis. For example, the description will state that 37 head of cattle are located at a particular location and it is estimated 80% will achieve a "choice" carcass quality grade. The weight range, the weight when the animals sent on feed, the number of days fed will also generally be included. Cattle are split between "light utility" (or LU), "heavy utility" or "breaker". Prior to the sale Equity contact the packers by telephone to stimulate interest in the lots for sale: *"This is a people business as I think we all agree. Those packers... I talk to them at least every other day of the week, sometimes everyday, and they learn the sound of my voice and the words I use in trying to describe the lots and we build that rapport."* (SG)

Initially the NEMI system was used by Equity for lambs. In 1995 it was also being used for pigs, dead livestock and cull cows. Equity adapt the structure of the auction for each new commodity, changing the system parameters. For example cattle bidders bid on 50 cent increments, but lamb buyers prefer to bid in quarters.

The impetus for the electronic marketing of lambs by Equity was that the packers who bought lambs withdrew from Northern Wisconsin. Producers had to transport their lambs to distant markets, which was costly for producers with only small lots for sale. Equity started consolidating semi trailer loads from a range of producers. Outside the state the lamb packers were becoming more concentrated and therefore stronger in their negotiations with producers. In 1995 the United States was losing lamb packers at the rate of one a month. The Equity strategy was to use the electronic market to improve the price discovery mechanism for distant sales and be able to offer packers an efficient uplift of graded lambs at a central location, avoiding the cost of uplifting part lots.

Equity publish a schedule of lamb sales weekly for Wisconsin throughout the year. Every Friday Equity identify all the lambs in Wisconsin that will be delivered the next Tuesday morning. They assemble these

lambs into load lots. The auction is held at 10.30 am on Friday and the details are passed to the ten physical markets. Producers deliver their lambs to the markets between 7.30 and 10.30 on Tuesday morning. The numbers, weight, quality, sex, age and condition are already known. Equity sort them, grade them, evaluate them, weigh them and pay the producer. Equity put the lambs on the buyer's truck.

Approximately 65% of all sheep raised in Wisconsin were being sold electronically in 1995.

Approximately 90,000 sheep and lambs were killed in the United States each week, but with Equity's electronic Corn Belt Lamb auctions selling only 150,000 per year. By 1997 electronic lamb sales had fallen to an estimated 100,000, of which 60,000 would be sourced from Wisconsin. Equity's sheep and lamb division comprises 938 producers, but this is only a small element within the whole co-operative, which has 50,000 members. When asked whether being a co-operative affected their electronic market strategy they were uncertain: *"If you talked to our 50,000 members they would probably know very, very little about electronic marketing"* (SG).

In 1995 Equity started a slaughter cattle auction using the electronic system, DLMA (Direct Livestock Marketing Auction). The motivation was the increasing concentration of packers: 65% of the beef cattle slaughter was by three packers and 80% of the fed cattle slaughter was controlled by three packers: *"If the buyer wakes up this morning and says "I am going to buy your animal for a dollar and one cent per pound hanging", did he just pull that figure out of fresh air? There wasn't a price negotiation, it was dictated that that is what he is willing to pay"* (SG). Gardner believed that electronic marketing of cattle would be most successful in remote areas, for example in Texas and Kansas, where producers have limited sales options. Equity have sold cattle for large feed-lots, but their successes have been the small private producer, *"putting them together to get the same clout as the big guys automatically for their size"* (SG). However, by 1997 Equity were only auctioning cull cows<sup>27</sup> in two grades, canner and utility, trading 15,000 per year. The plan to extend the system outwith Wisconsin and to trade slaughter cattle was unsuccessful because of the difficulty buyers and Equity had in trusting the assessments of third-party assessors.

Gardner did not see buyers and sellers bypassing the auction as a problem: "We have had packers bid 97 cents per pound for some Holstein steers which then sold electronically for one dollar. This would have cost the producer three dollars per hundred-weight, plus he would have to pay the transport. These experiences circulate and avoid sellers seeking to bypass the auction to save commissions."

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<sup>27</sup> Cows from dairy herds which have reached the end of producing milk.

### *Commission*

In Equity's electronic lamb auctions the commission is paid by the seller on a per head basis. In 1996 the commission was \$2.60 per lamb, which was lower than traditional auctions by as much as 50%. The producer must bear the cost of delivering his lambs to the collection point. The commission on pig sales was 40 cents per hundred-weight.

Equity see the future of the physical markets as assembly points for the consolidation of stock. The importance of the live auction is expected to diminish: "*The packers are all going to work on value based marketing, we are all very well aware of that*" (SG). The packers want to pay for consistent carcasses rather than have the uncertainty of buying live-weight. Equity expect packers to be interested in systems which are showing lambs for delivery 3, 4 and 5 days so that the packer can fit them into their kill schedule.

In 1995 Purcell, the instigator of the EMA system from which Equity's NEMI system had developed, was sceptical about Equity's commitment to electronic selling: "*I think they are operating it - I think a clerk in their office is doing it.*" He believed they were not trying to expand the volumes and argued that the idea of electronic markets keeps resurfacing, principally due to increasing purchaser concentration. As the packers have withdrawn from the Eastern Corn Belt (Ohio and Indiana) there are fewer local buyers. This has made producers see the potential use of electronic markets to connect to remote buyers. Purcell claims it will be necessary for producers to be willing to sell on a carcass evaluation basis before electronic auctions will be widely used for fed (slaughter) cattle and he claims cattle feeders are unwilling to do this. He claims this is because producers believe they get good deals selling on average prices per head, allowing them to slip some poorer stock in the lot. Purcell doubts this is really an advantage to producers because the packers understand what the feedlots are doing. Selling on carcass description is more common in the Northern states, but it is rarer in Kansas, Oklahoma, Texas and New Mexico: "*It is kind of interesting that in 1995 we are still guessing on what they are really worth.*" (WP)

Koontz and Ward (1993) surveyed users of the NEMI electronic lamb auction in Oklahoma to identify the factors affecting producers' participation in electronic lamb markets. The Oklahoma auction traded as the Corn Belt Electronic Market (CBLEM) and was operated for an Oklahoma auctioneer by Equity using their computer in Wisconsin. The system replaced an existing Oklahoma based teleauction in 1982. Koontz and Ward surveyed 2544 Oklahoma sheep producers in December 1989. Factors found to be positively related to electronic market use were location near a lamb collection point, prices received, selling larger lambs and the importance of sheep sales in total income. Factors negatively related to electronic market use were non-farm residency, spring lambing, non-commercial sheep operations,

experience of higher education and gross farm income. On the basis of this study they proposed that to improve the success of electronic marketing system operators should provide more collection points and provide detailed evidence of the prices received electronically.

### **Building the North American Electronic Markets**

The conception of remote access markets was centred on two groups: academic agricultural economists and existing market intermediaries. For both groups electronic markets appeared to be a response to the decline of competitive markets. Agricultural economists, including Henderson, Sporleder and Purcell, saw electronic markets as a means of maintaining “efficient” competition, while existing intermediaries saw electronic markets as a means of arresting their decline. Henderson et al. (1976) were able to problematise “thin” markets and propose electronic markets as a solution, enrolling USDA support, the participation of agricultural economists at other universities and IT expertise from commercial firms who could be persuaded that electronic markets would be commercially viable. The examples of Telcot and the Ontario hog market was enrolled to demonstrate the technical and economic feasibility of electronic trading to other actor networks being enrolled. Following Callon’s terminology, the creation of a USDA funded programme to part-fund pilot projects represented the creation of a negotiation space in which the technical elements of the systems could be developed, with the role of the USDA simplified. While the conception stages were completed within this stabilised negotiation space, producing working pilot systems, the adoption stages were difficult, with all the USDA projects except ECI having difficulty enrolling buyers and sellers. The only USDA funded systems to proceed through this stage into commercial use were ECI in eggs and NEMA in lambs. In each case the instigators were able to enrol existing intermediaries as operators of the system, enrolling in turn stable actor-networks of buyers and sellers (users of the telephone ECI system and Tel-O-Auction system) and the system functionality was designed with these communities in mind, emulating and automating the familiar existing procedures. The other systems had to attempt to both deduce the needs of users during system conception and enrol them during the adoption phase. In retrospect (Purcell, 1984) it was recognised that there was a gap between the academics’ theoretical conception of the markets and the pragmatic conceptions of market participants. By implication this gap was not bridged by either the industry advisory groups or user surveys undertaken, with both the surveyed farmers and processors and those on the advisory groups being treated within the process as the simplified voice of the potential user but failing to represent them accurately. This gap led to the creation of systems (CATTLEX, HAMS, CATS) which did not emulate existing market processes, creating a barrier to user acceptance. For Henderson et al. (1976) the adoption barriers would be overcome by making market participation mandatory, following the model of the Capper-Volstead Act of 1922

which enabled the creation of mandatory producer co-operatives. However, while Henderson et al. enrolled USDA support for electronic markets as a response to thin markets, they failed to enrol their commitment to make the proposed electronic markets mandatory.

For Telcot, ECI and the Ontario Hog markets the development of remote access markets was facilitated by their existing networks of users, providing a clearer ability to speak on behalf of their users in the conception phase and reducing uncertainty in the adoption phase. The Ontario OLEX system was also conceived by an existing auctioneer, Wideman. He was able to draw on the experience of the USDA pilots, his knowledge of the livestock industry and contacts with IT specialists. Combining these elements enabled him to limit the uncertainty in developing both the OLEX and NEMI system: the systems both emulated the EMA system which itself emulated the live auction. In both cases he had an enrolled user-base of OLEX live auction users and users of the USDA funded NEMA system.

In cattle sales satellite auctions have been more successful than electronic market systems in enrolling users. The satellite systems grew out of existing stockyard operators through the half-way stage of video and telephone auctions, the auction closely emulates the live auction and buyers only require a telephone and satellite television to connect to the auctions. The instigators therefore enrolled standard technological components (satellite television and telephone), existing procedures (auction calling and cattle descriptions) and existing social networks of sellers through the enrolment of agents and buyers through their contacts with feedlots.

The first two systems to be launched, Telcot and ECI, continue to operate, with the NEMI system occupying a niche role in lamb sales. However, as we shall see in the next two chapters the experience of the systems in North America, widely described in both agricultural and technological publications, became influential in shaping the development of electronic agricultural markets in Australia and the United Kingdom.

## **5. Australian Electronic Markets**

*Chapter 4*

*Australian Electronic Markets*

## **Introduction**

This chapter covers the development of the CALM livestock auctioning system in Australia. Interest in electronic marketing grew out of producer led experiments with electronic marketing in New England, New South Wales, in the late seventies. The Australian experience of electronic marketing parallels that of North America. A system was developed for use in New England, which was later used in Queensland and Western Australia. The Australian Federal Government's Australian Meat and Livestock Commission in 1983 funded an exhaustive study into the prospects for a nation-wide electronic auction. This report led to the development of the CALM system, drawing on the experience of auction systems in Australia and North America. The vision behind CALM was more ambitious than any previous system, and the development cost of \$11M was also much greater. As with the North American systems, the auction was less successful than expected, again due to the difficulties of ensuring participation of buyers and sellers. The complexity of the system, and therefore its start-up costs, became a barrier to licensing the system for use elsewhere in the world. In 1996, due to the Liberal government cutting government support for agriculture, a controlling interest in CALM was sold by the Australian government to a consortium of the two largest networks of livestock agents.

The description of livestock marketing in Australia is based on interviews with the instigators of the NELCM and CALM electronic auction systems. A search in the library of Australian Meat and Livestock Commission identified "*Report on the Feasibility and Economics of Establishing a Network for Electronic Sale of Sheep and Cattle Throughout Australia*", (Rickards et al., 1983) a report produced in 1983 for AMLC which formed the justification and specification for the CALM system, enrolling federal government support and industry involvement. The subsequent history of CALM was covered in an interview with D. Bruce, CALM marketing manager, supported by observation of the system in use.

## **Early Remote Markets in Australia**

Australia has a large livestock industry, with a herd of over 20M cattle and 150M sheep (Clarke & Jenkins, 1992). In 1977-78 51.8% of cattle in Australia were still sold at a price per head through live auctions, with 14.5% sold live-weight in auctions, 20.7 % sold dead-weight, 12.3% sold on description, 0.6% by consignment and 0.1% by other methods. In traditional live markets the small numbers of buyers in each market and the high costs of returning stock to the farm led to high price volatility. As in Britain and the United States of America, the proportion of stock passing through live markets was falling. In Australia there was also a regional factor, with stock raised in the remote north being consigned for finishing and sold in the more populated south east. In the 1970s and 1980s there were changes in the structure of Australia livestock auctioning. Selling on the basis of price per head was displaced by increasing use of

live-weight selling or dead-weight selling, which included the use of a grid to account for carcass quality, with purchase after direct inspection being replaced by sale based on description (Clarke & Jenkins, 1992). There was therefore some experience in Australia of trading cattle by description, with meat processors providing producers with a grid giving prices per kilogram for various weight and fatness grades. This form of trading on description was seen by Rickards et al. (1983) as leaving the producer in a weak bargaining position, with little competition, but was seen as providing producers with useful information about the specific needs of processors which would help producers more closely meet these needs.

The Australian Meat Board sponsored an international forum on carcass classification in Adelaide in 1972. This led to the Board undertaking research into the selling of livestock by description. Following a fall in Australian cattle prices in 1974, P. D. Wright, a farmer from New England, NSW, was instrumental in forming a group of 90 producers in New England, the New England Marketing Group (NEMG), to market their cattle by employing someone to co-ordinate offers. Wright also represented producers on the Australian Meat Research Committee (AMRC), the Australian national body responsible for sponsoring agricultural research. The AMRC supported research into the potential for computerising remote buying. Between 1977 and 1978 the AMRC gave 40 demonstrations of computerised selling using a simple demonstration program linked by an acoustic modem to a computer in Sydney. Rickards et al. (1983) described the response of graziers to these demonstrations as being "*most enthusiastic*". NEMG commissioned the Agricultural Business Research Institute (ABRI), a research institute at the University of New England, Armidale, NSW, to assess methods for improving the efficiency of livestock marketing. ABRI concluded that NEMG should develop a commercial version of the pilot system demonstrated by AMRC. In July 1979 ABRI started developing a computer system for auctioning cattle by description for NEMG. The development of this system took 30 months and was guided by advisory panels of potential buyers and sellers. A technical specification was produced, the computer software written, a computer was installed, links between the computer and the telex network were established, portable weighing scales were developed and cattle assessors were trained. The first sale was held using the NEMG system on February 19 1982. In April 1982 AMRC agreed to fund extending the system to the sale of lambs, with the first lamb sale being held in May 1983.

Elsewhere the large livestock agents were also experimenting with remote livestock selling. In 1977 Westfarmers started a service, Telstock, marketing stock on a dead-weight basis for producers in Western Australia. This was followed by Farmers Grazcos Cooperative setting up a similar service, Livestock Link, in Victoria, which in 1983 was extended to New South Wales. In 1983 Elders started "Livestock Classification Sales" for sheep, cattle and pigs, using a weight fatness grid with stock assessed live by Elders, meat processors offering prices per kilogram dead-weight on the grid and the actual price being

calculated after carcass inspection and weighing (Rickards et al., 1983). CLASS, a computer-based cattle auction in Western Australia was also operating in 1983. CLASS was supported by the WA State Government and operated from their Department of Agriculture. CLASS used the NELCM software, but allowed producer or agent grading with compensations for misdescription (Rickards et al., 1983). The Queensland Meat Industry Authority also implemented a system in Queensland, calling it Quest, but this only completed eight sales. Wright is quoted by Le Gras and Gardner (1996) as saying that the technology in CALM was “designed, tested and proven” within NELCM, CLASS and QUEST.

New England Livestock Computer Marketing Pty. Ltd. (NELCM) operated the NEMG developed system. On the NELCM system stock were weighed on the farm by independent assessors who estimated their fat and yield (dressing percentage). The details collected by the assessor were entered into a central computer which telexed a catalogue to meat company buyers. The stock were then auctioned on the computer, with buyers either bidding using telex links or by notifying the auction operator of their maximum bid for a lot. In the NELCM system there was no correction for misgrading. Rickards et al. noted four disadvantages with the NELCM system: the cost of independent assessment; the need to weigh stock on the farm; low levels of participation by small local buyers; and the inefficiency of the system for auctioning small lots. The system was initially based on a Datapoint computer with telex links connecting to buyers. The telex links were replaced by Commodore 64 microcomputers linked by telephone to the Datapoint. The total cost of hardware was \$12,000 centrally and \$30,000 to provide Commodores for thirty buyers. During its operation the system traded \$60M of livestock. Rickards et al. noted that telecommunications networks would be more efficient for higher volumes. At that time Austpac, the Australian national X.25 network was not yet available locally in rural New South Wales (Rickards et al., 1983).

AMRC established a committee in 1982 to assess the extension of the NEMG system across the whole of Australia. This committee sponsored a detailed study by ABRI, leading to the submission of a report by Rickards, Lacey and Griffiths in November 1983 (Rickards et al., 1983). As part of their feasibility study for an Australian national electronic market Rickards et al. surveyed users of the NELCM system. The 114 producers surveyed were asked the advantages of using the system.

**Table 3: Advantages by Producers of Using NELCM**

Stock remain on property until sold	60%
Minimum handling/stress	52%
More competition	33%
Cheaper to use	28%

Producers who had registered with NELCM sold on average 20% of their stock through NELCM, but 30% had not sold any stock using the system. Producers believed that selling cattle using NELCM on average gave a \$10 per head net benefit on cattle over local saleyards, with only 13% saying that there was no net benefit. The major area of concern expressed by producers was the credit risk in using the market. In live saleyards the agent guaranteed the payment, but in using the electronic auction producers had to decide whether to use an agent. If an agent was used the agent's commission wiped out the advantage of using the system, but without an agent producers were uninsured. To overcome this concern NELCM quickly introduced a credit risk insurance scheme for producers, giving 80% cover for a fee of 0.75%. At the time of the survey 35% of NELCM users were still using an agent, principally to guarantee payment but also to advise on reserve prices and to canvass potential buyers, for which they were paying on average 3.3%. Rickards et al. were keen to involve existing livestock agents in the operation of the proposed national system: *"Any national livestock selling system will clearly have to provide more opportunities for agent involvement (e.g. through assessment, interlotting of stock for sale, involvement in store markets) if it is to win the support of the agency profession. However, agents will also need to show their willingness to become involved in computerised selling initiatives if they are to maintain their market share. The NELCM survey clearly indicates that a significant proportion vendors are prepared to sell direct if the agency profession does not support their use of this selling venue."* (Rickards et al., 1983, p 26).

Rickards et al. also surveyed 21 buyers who were registered with NELCM. Buyers were asked what forms of stock assessment they would be willing to accept.

**Table 4: Forms of Stock Assessment Acceptable to Buyers**

Willing to accept producer assessment with grid adjustment	50%
Willing to accept agent assessment with grid adjustment	52%
Willing to assess agent assessment without adjustment	14%
Not willing to accept agent or producer assessment	28%

Buyers were concerned that both producers and agents were liable to be biased in their assessments of stock. Of the 28% unwilling to use agents or producer's assessment, the most frequent reason cited was that the adjustment for misdescription would not compensate buyers who had very precise requirements and who would find themselves with carcasses that they had no market for. Buyers were surveyed on their attitudes to alternative institutional structures for the electronic market. 93% of buyers favoured a single network operated by an independent body, with 64% favouring a national system and 29% separate state systems. Only two buyers favoured a single network operated by a consortium of agents, one of whom was a subsidiary of an agent and the other a company which insisted on buying through agents. No respondents favoured the establishment of competing agency networks.

Rickards et al. (1983) forecast the expected volumes of livestock which would be traded on a national electronic auction system. They predicted that 30 buyers would participate in each sale, that 16,000 producers, or 11.7% of establishments with cattle or sheep would enrol, with 6506 actively selling through the system, and that 520 agency offices would participate. They estimated initial annual trading volumes as 15,000 lots of cattle (equivalent to 375,000 head in lots of 25) and 5,000 lots of lambs (equivalent to 1,000,000 head in lots of 200). The longer term target volume was forecast as 39,000 lots with an "optimistic" forecast of 100,000 lots per year.

Housley Computer Communications Pty. Ltd. carried out a technical assessment for the national livestock sale. They identified that in-house computers would give lower long-term costs than using a computer bureau, proposing that a pair of DEC VAX 11/370 computers costing a total of \$300,000 would give the processing capacity and system reliability required. Housley concluded that Austpac X.28 would be the most effective means of connection for most users, with Austpac X.25 linking the host computers to the network. Due to the number of buyers using telex a facility for telex connection was also recommended. X.28 charges were \$3 per hour independent of distance and data volume, giving an estimated annual connection cost of \$30 - \$50 for vendors, \$150 for agents and \$1,150 for buyers. The telecommunication

charges for the system operators were estimated as being initially \$30,000 per year, rising to \$50,000. The estimated resources required to develop the software were 4.5 person years at a cost of \$500,000 (Rickards et al., 1983).

Rickards et al. put forward two arguments for public sector support for an electronic livestock market. First, they argued that a private sector developer would not be willing to invest in the determination of trading rules and a system of livestock description because they would not be able to prevent an alternative operator appropriating their knowledge. Second, they argued that the strongest argument for government involvement in the electronic market was to gain ownership of the market information, whether through purchasing the market information or through ownership of the system. The danger of free-riders trading on the basis of data gained from the electronic market was recognised, quoting from Henderson and Holder (1982) describing the experience with the USDA pilot markets in the United States : *“experience to date clearly points out that many more people are interested in accessing electronic markets in order to obtain information on other people’s trades than are willing to bear the costs of actually trading on these still infantile systems. Yet largely unresolved is finding a way to get information users to bear their fair share of the costs.”* Rickards et al. saw that the danger of free-riding by traders using the system generated prices to set price levels in direct deals was significant because trading by description generates reliable price data. This price data would be freely available and direct trading would incur lower costs than selling through the auction. However, exactly how the proposed system would avoid these problems was unclear (Rickards et al., 1983).

Rickards et al. considered the argument that there should be government involvement in regulating the electronic auction system. They feared that it would be a natural monopoly in which the system operator could abuse their position. They considered whether the economies of scale inherent in an electronic market and the barriers to setting up a rival network would make it a natural monopoly. Rickards et al. identified the computer hardware, computer software, specification of rules and procedures, the need to have skilled staff and *“a favourable market presence (e.g. goodwill and perceived on-going commitment to clients and specialised staff)”* as four barriers to entry. They believed that of these the development of the computer software would form the greatest barrier to entry, but that this would not be so great a barrier as to prevent the market being contestable. They believed that the economies of scale would lead to the emergence of a single electronic marketing system, but the contestability of the market due to low barriers to entry would avoid the natural monopoly being exploited and preclude the need for government involvement.

### *The Establishment of CALM*

The AMRC's support between 1978 and 1984 to develop pilot electronic markets and assess the feasibility of a national market totalled \$1m. Following the report of Rickards et al. the Australian Meat and Livestock Corporation (AMLC) decided to support the setting up of a national electronic market, CALM (Computer Aided Livestock Marketing) (Clarke & Jenkins, 1992). The AMLC was established in 1977 by Act of Parliament to market Australian meat and livestock. Membership of AMLC includes producers, processors, exporters and retailers (Clarke & Jenkins, 1992). The need for reliable quality standards and descriptions for livestock had been identified by Rickards et al. as a key element in a viable electronic market. The Authority for Uniform Specification for Meat and Livestock (AUS-MEAT) was established at the same time as CALM to develop and administer a national description and classification system for meat and livestock. The AUS-MEAT programme includes a quality assurance programme, quality assessment programme for beef, accreditation for domestic meat processing and quality accreditation for the feedlot sector (Smith, P., Tan, Q. T., Ruello, N., 1995). Unlike the equivalent systems in the United States, Canada and Europe, AUS-MEAT were aware that the specification would be used in electronic markets when they were developing it.

Between October 1984 and July 1987 \$6m was invested by AMLC in developing the CALM system, with \$5m committed to cover operational losses up until the system became self-funding in the early 1990s (Jenkins & Clarke, 1992). The aim was that once this period was completed the volumes of livestock traded on CALM would make the system self-financing. The investment in CALM was made by AMLC to achieve three objectives:

- to improve operational efficiency, by lowering the costs of sale and transport and decreasing livestock stress and meat bruising;
- to improve market pricing efficiency, by increasing market information and enabling participation in the market by remote buyers;
- to improve meat quality and the match between product characteristics and market demand, by enabling direct transport of livestock to abattoirs and increasing feedback to producers.

Key features of the CALM systems were to be: a national network, with low cost access to all industry participants; the provision of pre-trading information for buyers and post-trading information for sellers; independent assessment of stock; and the availability of alternative bases for price quotations and bids, with a bias to the use of carcass classification. Areas of concern in developing the system were ensuring the maintenance of a competitive market structure; the protection of sellers from risk of default by the buyer; support for trading with various lot sizes; support for independent assessment in closely settled

areas, but seller self-assessment in remote areas where independent assessment would be costly; protection for buyer against mis-description by the seller; and fairness in system charges, in particular the risk of participants using the price information from the system for price setting in direct sales without paying to trade stock (Clarke & Jenkins, 1992). The breadth of the specification of CALM committed the AMLC to the development of a system more complex than any system developed before, and therefore more costly, both to develop and operate. However, if the system achieved the sales volumes forecast by Rickards et al. it would become self-financing.

CALM became operational in November 1986 and was launched commercially on 1 July 1987 (Clarke & Jenkins, 1992). CALM was owned by the AMLC and run by a board comprising representatives of cattle, sheep and pig producers, the meat trade, meat exporters, stock agents and the AMLC. The board represented the range of "conflicting vested interests" in the meat industry. CALM was resisted by many stock agents who feared that it would lead to them being by-passed (Le Gras & Gardner, 1996). In 1992 CALM Services, the operating company, employed 33 staff. CALM was initially funded by increasing the industry levy used to fund AMLC services. The objective was for CALM to be self-supporting by the early 1990s. The AMLC levy applies to all Australian animals slaughtered or exported live. Rickards proposed that the levy to support CALM would be 10¢ for cattle and 1¢ for sheep and lambs. The levy was set at 20¢ per head for cattle, 7.2¢ for calves, 2¢ for bobby-calves and 1¢ per head for lambs and sheep. The levy raised \$1.3M in 1987-88, \$1.8M in 88-89 and \$0.3M in 89-90. The levy ceased on 30 April 1989. CALM's losses since 1989 have been met from AMLC's general industry levy (Clarke & Jenkins, 1992). In December 1987 500 producers were using CALM, which grew to 6000 of the 20000 registered livestock producers in Australia by 1996 (Le Gras & Gardner, 1996).

### *The Operation of CALM*

To enter a lot for a CALM sale the vendor arranges for a CALM-accredited assessor to assess the stock. The assessors are graded into four levels and are identified in the sales catalogue. Assessors are often employed by livestock agent. CALM's Comprehensive Operating Conditions define detailed conditions of sale for each type of livestock. These cover assessment, procedures applied when a lot is misdescribed and details of conviction and arbitration services. Only five disputes were submitted to arbitration in the first four years of operation (Clarke & Jenkins, 1992).

The sale catalogue is released a day before the auction. In 1987 there was a weekly CALM cattle sale and bi-weekly sheep sales (Smith, P., Tan, Q. T., Ruello, N., 1995). In 1997 CALM held a Monday afternoon sale of Western Australian cattle, Tuesday and Thursday afternoon sales of sheep and lambs from the

eastern states, on Thursday morning a pig sale, and on Friday mornings a Tasmanian cattle sale followed by a mainland cattle sale (D B). The CALM system supports three types of livestock selling: simultaneous auctions, sequential auctions and the CALM exchange. The sequential auction is a re-creation of an English sequential auction, the traditional form in Australian auction markets. Lots are displayed and bids accepted until the highest bid is received at which time either the lot is sold or else the lot withdrawn if the reserve has not been reached (Clarke & Jenkins, 1992).

Simultaneous auctions form the largest part of CALM sales and were the most significant innovation in CALM over NELM (D B). In a simultaneous auction the lots for sale are displayed and bidders can bid incrementally for any of the lots on offer. The bidder can see which of the lots he currently has the highest bids for and which of the lots are near to and which are past their reserve prices. With a screen of 20 lots each will be on offer for a minimum of five minutes. A bid on a lot extends the life of the auction by one minute. The auction is completed once no bids have been received on any lot for a minute. The simultaneous auction mechanism was derived from the auction mechanism in the CATTLEX pilot auction system developed by Texas A&M, part funded by the USDA. The simultaneous auction provides bidders with a deeper view of the market than they would have in a sequential auction, where early lots may sell for higher or lower than average prices because buyers have assumed that there is a shortage or surfeit of supply. An auction may involve a number of screens, each of which takes 30 to 40 minutes to complete (Clarke & Jenkins, 1992). Lot numbers and current prices are displayed on-screen. The seller may set a starting price or it may be set by the market operator based on market knowledge. By keying the lot number a bidder makes a bid for that lot one increment higher than the outstanding bid. The increments were \$2 per head on cattle, 20 cents on sheep and 50 cents for pigs (Clarke & Jenkins, 1992). The bidders terminal display on CALM shows the most recent bid charged indicated by a cursor. Bids above the reserve are displayed in bold. The CALM system allows program bidding in which bidders set their computer to automatically bid on lots up to a specified level. Lots are sorted by region and by type of stock. Lots may be sold as a price per head, per kg live-weight, per kg carcass dead-weight or per kg dead-weight with a grid correlation. Lots not assessed by a qualified assessor must be sold using the grid (Clarke & Jenkins, 1992).

The CALM pig auction operates with a different auction mechanism, described as "semi-sequential" in which ten lots are displayed and may be bid for but lots are sold sequentially. The pig auction was the responsibility of a single specialist - "it was his baby" (D B). The software had to be substantially rewritten to auction pigs because of the need to accommodate 24 trims (carcass dressing standards), and the developer took the opportunity to radically change the auction mechanism (D B).

In the CALM Exchange a seller offers a lot with a reserve price which may or may not be displayed, but there is no auction.. Buyers can connect to the system at any time and place offers for the lots which will be accepted if they exceed the reserve (Clarke & Jenkins, 1992). In 1997 very little stock was being sold through the CALM Exchange, but it was hoped that the numbers would increase because a free placing on the Exchange was being offered to lots which did not sell in auction (D B).

To persuade sellers who sold through live markets to use CALM they introduced *interface sales* as a hybrid between the CALM sales and a live sale. In the interface sale a computer sale runs with the stock for sale in a local saleyard, giving buyers who attend the sale yard the opportunity to relay their bids to a CALM representative who relays them to the system by cellular telephone. It was hoped that this type of sale would educate producers about the grading system used by CALM and the benefits of using the system. According to Dick Bruce, the CALM marketing manager: *“The jury is still out on how successful interface sales have been”*. They are seen as being commercially successful, generating additional sales on the system but have not been successful in drawing producers to sell on the full system. According to Dick Bruce the problem is convincing sellers of how competitive bidding is on the CALM system where they only see the local bids: *“I can say to sellers ‘you had twenty seven lots and CALM bidders bought 12 of them and in CALM bidders bid on 21 of your lots with a total of 416 bids’, it has not transformed into this guy running back to us saying ‘I sell 3000 cattle per year and I want you to sell 1000 through your CALM auction ‘ “*. For the agent who runs the auction, interface sales lead to greater participation, and for the large agent networks such as Westfarmers Dalgety and Elders they allow them to use their branch networks more efficiently because they can avoid the costs of driving clients cross country to buy in neighbouring sales. (D B)

CALM includes four options for trading(Smith, P., Tan, Q. T., Ruello, N., 1995):

1. per head (\$/head)
2. liveweight (cents per kilogram weighed on certified scales)
3. carcass weight (aggregate weight, subject to adjustments for bruising)
4. quality grid (price on each carcass with variations for weight, fat, dentition specified by the purchaser and bruising specified by the bruising compensation schedule)

CALM relies on accurate description of the stock by the vendor. Disputes were referred to the agent and, if unresolved, then to a panel of arbitrators, with the producer depositing with CALM the amount in dispute (Smith, P., Tan, Q. T., Ruello, N., 1995).

CALM have a listing fee per head, which is equivalent in form and level to the “yard dues” levied in physical markets. On top of this fee the agent charges a further commission. Listing fees in 1997 were

\$3.50 for cattle over \$300 and \$2.50 for cattle under \$300. The fees for sheep and lambs are on a sliding scale: under \$5 was 35 cents, \$5 - \$20 was 25 cents, \$20 - \$50 was 30 cents and over \$50 was 35 cents. In interface sales the CALM fees are the same as the standard CALM auction fees (D B). The catalogue identifies the vendors but bidders are anonymous to all users except the market operator. CALM Services notifies vendors of the successful buyer. Where the highest bid has not reached the reserve but is close, the highest bidder is notified the reserve and can either accept it or negotiate with the vendor (Clarke & Jenkins, 1992).

Since 1990 producers have been able to access data on the classification of stock sold through CALM. Since 1991 CALM have provided Market Intelligence, including statistical reports on past sales, price trends, market commentaries, which is supplied free as a means of encouraging producers and stock agents to use CALM (Clarke & Jenkins, 1992). Although this service was continuing in 1997, CALM realised that the advent of low cost data services using the Internet would lead to the emergence of lower cost suppliers of agricultural data.

### *Technical Aspects of CALM*

The CALM system is made up of four elements (Clarke & Jenkins, 1992): application software, central computer, communication network and remote workstations. The application software was written in 1986, mainly in COBOL. The original CALM software was tendered for by AMLC and developed by Main Nicholas, an Australian software company. In 1997 CALM was employing two people to maintain and develop the software. The central computer is a pair of DEC MicroVAX 3800 and 3600 supporting the operational system and system development. These computers are operated by AMLC's Computer Division and are used by the AMLC for other uses. CALM uses Telecom Australia's X.25 packet switching network, Austpac, with leased lines to the two largest chains of livestock agents (Dalgety and Elders). This supported a maximum of 200 connections, with generally only 60-100 connections used for auctions. The remote workstations installed in the offices of buyers, agents and producers could be dumb terminals. In 1992 they were made up of VT100 (65%), Prestel (Videotex) terminals (10%) and PCs running terminal emulation (25%). By 1997 users were increasingly using Windows-based personal computers and CALM were developing a Windows version of the programmes for entering information on the assessment of lots and for the downloading of catalogues (D B). The initial connection charge for users to connect to CALM was \$25 per hour which remained unchanged by 1997 (D B). By 1991 CALM estimated that each lot sold on the system generated 1.6 hours of connection time and \$40 in revenue (Jenkins & Clarke, 1992).

Clarke & Jenkins (1992) found that gaining acceptance for electronic trading using CALM had been slower than expected. Livestock agents, physical auction operators, buying agents, hauliers and the print and broadcast media were identified as seeing CALM as a potential threat to their livelihoods (Clarke & Jenkins, 1992). To overcome this resistance CALM sought to operate through existing livestock agents. It was expected that early adopters would be the large agents with wide branch networks. However, many individual branch managers resisted CALM. Early producer users were often producers with recent connections to agricultural colleges which gave them an awareness of IT usage. Clarke & Jenkins (1992) identified that market penetration was highly dependent on local champions who “proselytise the local community”. These champions were either established agents or new entrant independents. The willingness to use new entrants to source stock was seen as lever to encourage existing agents to source stock in their areas to prevent someone else offering the service (D B).

There is no charge for registration as a CALM user. Livestock agents who supported CALM were rewarded by being promoted in CALM’s contacts with producers. To sell the system to producers CALM deliberately complies with conventional stock delivery and payment terms. Transit insurance is provided free and a local-rate telephone number is provided for contacting CALM. The communal element of the physical auction is maintained by encouraging agents to invite producers to view the sale in their local office. To meet the needs of buyers assessors were identified, bidders remained anonymous and there are compensations for misdescription (Clarke & Jenkins, 1992).

**Table 5: Livestock sales through CALM<sup>28</sup>**

	89/90	90/91	91/92	92/93	93/94	94/95	95/96
Cattle	204,141	243,421	272,121	224,824	312,554	233,716	176,429
Sheep <sup>29</sup>	615,757	1,334,403	853,740	1,054,306	1,086,210	1,325,331	1,603,111
Lambs	625,573	564,054	376,469	275,102	429,721	514,538	485,875
Pigs	45,979	40,366	40,466	54,660	87,611	82,480	56,228

<sup>28</sup> From Smith, P., Tan, Q. T., Ruello, N., 1995 up-to 92/93, then statistics supplied by CALM.

<sup>29</sup> The surge in sheep sales in 90/91 was due to the use of CALM in the national flock reduction programme.

The 200k cattle sold in 92/93 only represents 1% of total Australian cattle sales. CALM exploited the Brucellosis and Tuberculosis Eradication Campaign (BTEC) in Northern Australia which forced the compulsory sale of stock from infected herds, and the Australian Wool Corporation's Flock Reduction Scheme in 1990. CALM sold 13.5M sheep for \$42M. CALM also utilised their communication links with agents and producers to exchange information on the Merino Flock Register (Clarke & Jenkins, 1992).

In February 1988 CALM employed 19 fieldstaff, but only 16 in 1996. In 1988 it had 600 cattle assessors and 400 sheep assessors - by 1996 it had 4,200 registered assessors (Le Gras & Gardner, 1996). The growth in numbers of assessors is misleading, as it includes all the people who had been put through the CALM course on livestock classification. The vast majority of these people were not actively assessing stock for CALM, with many taking the opportunity to attend the course as part of their wider education in the meat industry.

By 1997 sales of cattle on CALM were predominantly feeder cattle: "If anyone has a vested interest in CALM not succeeding it is those people who are buying fat cattle for meat works, because their life revolves around touring the sale-yards and developing strategic alliances with processors and the largest producers to negotiate direct sales. If anyone could pot-hole us, these people would do it" (Dick Bruce). Also all the major meat processors maintain a presence in the major sale-yards so they have little incentive to buy remotely. (D B) Feeder cattle in Australia are usually sold in live markets \$ per head with the stock weights unknown to buyers. (D B)

The number of buyers connecting to CALM auctions varies, but can be as high as 40 of whom half will be actively there to buy. In sales of slaughter sheep and lambs there is a core of 20 to 25 regular buyers. Sales of slaughter cattle on CALM have declined because the cattle market has been depressed in 1997 for two years, in which direct selling has become dominant, but this has been hidden in the overall sales figures by an increase in store cattle sales. In the market for slaughter sheep and lambs the system has been more successful, with two of the largest mutton processors and two of the largest lamb processors sourcing up-to 20% of their throughput from CALM, saving one full-time buyer each. Other lamb and mutton processors tend to use CALM to top-up their schedules. The market penetration of CALM varies geographically, with 30% of the Tasmanian lamb and mutton market, where stock is generally bought by processors on the Australian mainland, but negligible market share in Victoria where, according to Bruce, there "*is still a sale yard mentality*". In slaughter cattle sales 60 - 100% of sales are now direct between producers and processors (D B).

The CALM system has suffered from assessors defecting from the system. Some assessors initially were assessing and offering livestock on CALM every week and then gained a reputation with processors and

“white anting” occurred, in which the processors went direct to these assessors and offered them a commission for sourcing stock bypassing the electronic market. Assessors realised that they could become “pseudo-agents” avoiding the CALM auctions. Similarly, producers who regularly used CALM realised who the processors were who were particularly interested in their stock, who they may previously have not known about or discounted because of the transport distances involved, and were able, having learnt about the description of their stock, to deal directly with the producers. These defections were a greater problem in undermining the cattle auctions than the sheep, with CALM unable to halt the trend. (D B)

### ***CALM Beyond Livestock***

Since 1989 CALM has been subcontracted to the National Grain Exchange for trading grain in Australia. In 1992 opportunities had been identified for extending CALM to other agricultural products, including hides, wool, boxed meat, carcasses, cotton, tobacco and market garden produce: *“It would even be possible, although not necessarily sensible to offer services internationally, bypassing local agents for overseas buyers.”* (Clarke & Jenkins, 1992). In 1994 CALM auctioned milk runs in Brisbane. In January 1995 a feasibility study was completed for the Queensland Banana Growers Federation and discussions were made with the Australian United Fruit and Vegetable Growers Association on establishing fruit and vegetable markets (Le Gras & Gardner, 1996).

### ***CALM Beyond Australia***

From its development it was realised by CALM that the system was one of the most advanced in the world and that opportunities would exist to licence its operation in other markets. The system was viewed by Aberdeen and Northern Marts when they were considering setting up an electronic livestock market in the United Kingdom in 1989. Gardner, the CALM chief executive from 1985 to 1996, noted in 1996: *“Internationally, despite some genuine but poorly funded attempts in the United States, Canada and Europe, there is no system available anywhere else in the world that currently can be compared with CALM. This potential provides CALM with a unique opportunity to export Australian technology”*( Le Gras & Gardner, 1996).

Fletcher Challenge, a diversified New Zealand agriculture enterprise, bought the right to operate CALM in New Zealand. Fletcher Challenge owned Wrightsons, which with Elders was one of the two largest livestock agents in New Zealand. They operated the system for eight months in 1992 running it on the AMLC computers in Sydney, but it was not successful. Dick Bruce, CALM Services marketing manager, said that this failure was because the New Zealand carcass grading system was different to the AUSMEAT standard and that the traditional structure of the livestock industry in New Zealand was different to that in

Australia. The system was used principally to market lamb. In the New Zealand lamb industry saleyards are not well-established and there is a tradition of agents sending out graders to select livestock to meet the needs of the freezing works to whom the stock would be sent directly. This widespread experience of direct dead-weight selling became an obstacle to electronic auctioning. According to Gardner, the chief executive of CALM at that time, the market was dominated by four meat processors who effectively boycotted the system due to a fear that it would lead to higher prices (HG). Also there was resistance from agents who viewed the system as a threat to their role in the industry (D B). Whereas in Australia CALM had some sole agents who could source stock, in New Zealand the auction was dependent upon the participation of existing livestock agents who saw it as competing with their other business. Negotiations to sell the CALM system to an Argentinean government agency in 1993/94 were blocked by a change of government in Argentina: *"I think the bloke we were dealing with was the Minister of Agriculture's brother-in-law."* (D Bruce). CALM also had negotiations with Vleissentraal in South Africa but they decided to buy the NEMI system from Canada.

### *Privatisation of CALM*

CALM had operated at a loss since its launch. In 1992-93 CALM's total loss was \$1.7M, which was covered by the AMLC levy. The losses were due to the high inspection costs and lower than expected trading volumes. The accumulated losses of the CALM system had reached over \$20 million by 1996. In 1996 the incumbent Labor government was replaced by a Liberal government committed to free market policies. The new government reviewed the meat industry, concluding that AMLC should be rationalised and the scale of its operations curtailed<sup>30</sup>. In this review it became apparent that either CALM would have to become a commercially independent operation or it would cease operation. Negotiations were held between AMLC and West Farmers Dalgety and Elders, the two largest networks of livestock agents, to agree a privatisation of CALM. It was agreed to sell 75% of CALM, split equally between them, for \$3 million. AMLC retained 25% of the equity with the intention of selling this share to other private sector investors. The \$3M was made available to CALM as working capital in exchange for AMLC ending all future commitments to support the system. Bruce believes that Dalgety and Elders can see a long-term future for electronic selling if it enables them to cut back on their nation-wide coverage of 600 branch agencies. Bruce believed that if CALM folded Dalgety and Elders would have eventually had to establish a similar system of their own. When established CALM had a force of 25 regional managers, which by early 1996 had been reduced to 14. Following privatisation the force was cut further to 7. The livestock assessment training role of CALM was also cut back. Of the people who attended the CALM funded

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<sup>30</sup> In the early 1990s AMLC's budget exceeded \$90 million per year (D B).

courses in livestock assessment the vast majority of participants attended for their general agricultural education, with only 1% of those trained going on to become CALM assessors. Bruce claimed that this rationalisation left CALM with a level of operations at which it would be able to break-even (D B).

### **Building the CALM Network**

The history of electronic marketing in Australia mirrors that of the United States: electronic markets proposed as a solution to the decline of traditional auctions. The catalyst in this problematisation was P. D. Wright, a producer, who saw co-ordinated selling as a response to a perceived lack of competition between buyers. NEMG, the producer group that was established, were then able to enrol university based resources and research funding for the development of a pilot computer systems and then an operational system for New England, NELCM. In parallel, existing intermediaries Westfarmers and Elders were developing remote selling on description and people in Australia became aware of the USDA funded market systems in the United States. The AMRC funded the study by Rickards, Lacey and Griffiths to evaluate and design a national electronic livestock market. Their pivotal report combined the economic analysis of markets used in the United States in Henderson et al. (1976), supported by an analysis of NELCM users and an awareness of electronic market experiments in the United States. The report was successful in enrolling the resources to develop CALM, a system more complex in its functionality than the systems developed with USDA funding in the United States. During the CALM conception phase the design of the system was founded on a survey of users and an economic analysis of market efficiency. It was implicitly assumed in Rickards et al. that the local NELCM network in New England could be scaled up into a national network. The operation of CALM was overseen by a board with representation from across the livestock industry. However, the failure of the system to develop as predicted implies that these individuals were, in Callon's terminology, enrolled but not mobilised, unable to articulate how their industry actor networks would respond to the existence of the electronic market.

In the CALM conception phases greater efforts were exerted on understanding the needs of producers than processors. The surveying of processors centred on their attitudes to livestock assessment, in particular what level of independence in livestock assessment and compensation for misgrading would be needed. It was implicitly assumed that if the producers and the agents were tied into the system the processors would be forced to use the system. The social network surrounding CALM was almost entirely made up of actors who had been active within the wider Australian meat industry. The genesis for CALM was the linkage between the pastoralists, who saw electronic markets as a means of strengthening their collective position relative to the increasingly concentrated meat processors as the influence of traditional markets declined, and the Australian government, through the AMLC, which saw electronic marketing as a means of

improving the international competitiveness of the Australian livestock industry. The producers gave the proposed systems legitimacy and the AMLC and AMRC could provide the resources to develop the system. Doubts about the technical feasibility of electronic auctioning were overcome by links to the USDA funded projects. The University of New England was brought in to take a key role in the development of NELM and in the specification of CALM. The federal government supported, through AUS-MEAT, the development and maintenance of the livestock specification systems necessary for the system.

In the adoption phases of NELM and CALM it was explicitly recognised that it was important to ensure the participation of the existing network of livestock agents. The agents provided a pre-existing national network linking in to producers and having the mostly easily accessible source of expertise for livestock grading. The weakness in enrolling the network of agents was that many agents were perceived to have a low commitment to electronic selling because it was in competition with their core business, and they could envisage a system in which the agents were displaced by specialist electronic marketing assessors.

The social network built during the CALM adoption phase was found to be unstable because processors could entice producers to defect from the network, in part by using the system prices to set prices in direct selling, except that the producer would avoid the market commissions, and also because the system provided a link between producers and processors which could then be exploited for direct selling. The network frayed further as agents realised that they could defect and offer a service linking producers to processors. In privatising CALM by selling a controlling interest to the two largest networks of agents the Australian government withdrew from the CALM network. Elders and Dalgety, who had previously been involved more peripherally in CALM, were then able to reframe CALM as another in their portfolio of services offered to producers.

## 6. British Electronic Livestock Markets

### Chapter 5

#### *British Electronic Livestock Markets*

*“Farmers find solace amid the cacophony of bleating, lowing and gate clanging that is the thriving auction mart. Rubbing besmocked shoulders with fellow farmers, comparing notes with dealers, sharing jokes with the canteen staff who slip whisky into their coffee, they feel strength in numbers there. In a profession changing with bewildering speed, they take comfort in the mart’s timeless rituals. The auctioneer’s banter is as much a sound of the countryside as is the first cuckoo. His ability to read the minds and interpret the twitches and nods of craggy-faced buyers is as much a part of rural folklore as is the shepherd’s delight of the red sky at dusk.” (N. Farndale)*

## **Introduction**

This chapter describes the development of electronic livestock auctions in the United Kingdom. The pattern of their development in the United Kingdom is distinctive relative to North America and Australia because five very similar competing systems emerged without government support. In the early eighties awareness grew in the United Kingdom of the electronic auction systems in North America and Australia. Following abortive attempts to develop electronic markets by producers and systems suppliers, ANM, a large Scottish agricultural co-operative, licensed the Canadian OLEX system and established a network of franchises to operate the system, which they called EASE. The pressure for auctioneers to become involved in electronic selling led to the development of two further systems based around networks of auctioneers, one of the EASE franchisees developed their own system and a group involved in EASE left and licensed the NEMI system from Canada. With the addition of a satellite auction system, by 1995 the UK had six competing remote livestock auction systems. With the total sales volumes not reaching the levels expected the satellite system and several franchisees of the other systems became insolvent.

## **Background to the Emergence of Electronic Markets**

In 1989 total slaughterings of livestock in the United Kingdom were 3,667,000 cattle and 20,338,000 sheep/lambs (MAFF, 1990). United Kingdom meat production in 1988 of 15,358,000 tonnes was less than a quarter of United States production (FAO, 1989), with the United States cattle slaughterings in 1990 being 33,242,200 (USDA, 1991). From the nineteen sixties in the United Kingdom, as in the United States, the proportion of slaughter livestock passing through physical auctions and the number of auctions were both declining, with producers increasingly selling their stock direct to abattoirs. United Kingdom beef production had risen during the eighties due to the imposition of milk quotas forcing farms to diversify. By 1991 14% of British beef production was going into European intervention stores. The industry was becoming increasingly concentrated, leading to fears that farmers were in a weak position: in 1989 9% of abattoirs accounted for 60% of cattle slaughtering (Grega & Ray, 1992). In the nineteen eighties, as the number of auctions fell, auctioneers became keen to explore new approaches to livestock auctioning. In 1992 90% of pigs, 50% of cattle and 25% of sheep were being sold dead-weight direct between farms and abattoirs (Kiely, 1992). By 1995 the number of live auction marts in the United Kingdom had halved to 227 in England and Wales and 40 in Scotland (Farndale, 1995). In 1996 this decline continued with several markets ceasing to trade as BSE further reduced the volumes of cattle being traded.

The abattoir industry had also been undergoing painful changes. The number of abattoirs in the United Kingdom fell from 1900 in 1971/72 to only 647 in 1992/93. The EC Fresh Meat Directive<sup>31</sup> required abattoirs to achieve European standards by 1 January 1993, leading to either the closure or major investment in many United Kingdom abattoirs. The failure of large numbers of United Kingdom abattoirs to achieve the standard led to 415 abattoirs being granted temporary derogation, but this gave these abattoirs an advantage over the abattoirs which had made large process investments to reach the standard (MLC, 1994a). The abattoir industry was also being affected in the late nineteen eighties by the growing concentration of meat retailing. In 1988 the five largest retailers sold 32% of red meat, rising to 41% in 1992, due to the growing importance of the multiple supermarket chains (MLC, 1994). In a survey of the multiple retailers' strategies for meat sourcing Hobbs (1996) identified three aspects of importance to retailers: consistent quality, traceability and consumer concerns over animal welfare. The pressure for traceability increased with the Food Safety Act 1990 which required retailers and processors to take all reasonable precautions and exercise all due diligence in ensuring the standard of food (Hobbs & Kerr, 1991). A buyer was quoted by AgraEurope (1991) as saying that: *"auction markets are in danger of being declared a 'no-buy' area by powerful supermarkets as they prepare to meet the supply chain audits demanded by the Food Safety Act. Supermarket buyers' biggest objection is the way animals sold under the hammer lose their identity"*. Gillon (1994), previously a manager of meat procurement for the ASDA supermarket chain, argued that supermarkets and producers should be working more closely together: *"I am very much in favour of producer groups. They are opportunities for the producer to get closer to the multiple retailer, via the abattoir, to create schemes which benefits to all concerned. I know that many producers have a problem with quality assurance schemes. However, my advice would be not to ignore them. The supermarket buyer is under constant pressure from his superiors to source a safe healthy product. Quality assurance schemes go a long way to ensure this."* In a survey by the Strathclyde Food Project (1992) a trend towards the development of close tripartite relationships between farmer, processor and retailer was seen for high value premium meat products. The initiative for this was coming from the retailer, with the processors working to the retailers' detailed specifications, setting farmers the conditions for stock rearing. In the main body of the meat market the survey found retailers developing close relationships with processors, but with less close ties to specific farmers due to the fragmentation of production and the less strict requirements. They found retailers antipathetic to auctions: *"There was a general dislike of the role played by the auction market and market prices in regulating supplies. Several retailers expressed the view that they would like to see the end of auction market systems and deal with designated farmers (via the processor) on the basis of annual or bi-annual fixed prices"*. All the retailers

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<sup>31</sup> Council Directive 91/497/EC of 29 July 1991.

surveyed welcomed farm assurance due to consumers' concerns about animal welfare, consumers' concerns about meat quality, due diligence requirements of Food Safety Act and the need for close product specifications. There was little support for the proliferation of regional farm assurance schemes, seeing an advantage in a single national scheme under the aegis of the MLC. Retailers differentiated between farm assurance, which was valuable for basic meat, and their own schemes for premium meat products (Strathclyde Food Project, 1992). However, in Hobbs and Kerr's survey (1991), only one of the four retailers placed an emphasis on farm assurance when assessing purchasing options, with the other three focusing on the specification and quality of the meat.

This antipathy to live markets of supermarkets was also taken up by the UK government. The government's policy statement of 1991, *Our Farming Future* (MAFF, 1991) argued: "*The government... considers that some existing practices may hinder the development of good marketing. For example, when selling finished stock many farmers remain strongly attached to live auction markets. They believe such markets give them the fairest return and allow individuals to be in control of their marketing. But the auction system is fragmented and the market signals it gives can be poor. Animals may change hands several times and it can be difficult to link the finished carcass to a particular producer. Premiums for quality are poorly defined. Producers may as a result find it more difficult to produce what the market wants. In the government's view, there is a need for the industry to examine ways of modernising those live animal markets which have not yet improved their operations so that producers can have renewed confidence in them.*" Whereas in the United States and Australia government agencies responsible for agriculture saw the growth of direct buying as a problem, the United Kingdom government attitude seemed to support direct buying, accepting the arguments put forward by the retailers. *Our Farming Future* does not specify the improvements in live markets it was urging the industry to adopt. However, this was taken as further evidence that live markets were an anachronism, with electronic marketing offering a route to modernisation. The attraction of electronic marketing in the United Kingdom was therefore a combination of the resistance of the multiple retailers to live auctions and the possible savings to farmers.

### **Early British Remote Bidding Livestock Auctions**

An early attempt to introduce remote buying by description in the United Kingdom was made in 1981 by the Meat and Livestock Commission (MLC) who introduced "Remote Controlled Bidding" which used buyers and sellers linked by computers. This system was designed to market pigs and grew out of a pig market initiative in King's Lynn, in which a sample of pigs was brought to the auction rather than the full consignment. This was adapted to allow remote bidding on pigs based on an assessment of carcass classification and weight with compensations for misdescription. This system was abandoned due to a lack

of commercial interest (Pearce, 1994). In 1986 John Taylor, a Humberside pig farmer, introduced a PRESTEL videotext pig marketing system called TABROTEC. He had been farming on a small forty acre farm in East Yorkshire in partnership with his brother since 1950, starting with a dairy herd and then diversifying into poultry and pigs. By 1984 Taylor was dissatisfied with the selling of pigs through the live markets, which allowed collusion between buyers, and believed that it might be possible to create a direct competitive market using computers. Through an interest in computers he was aware of the BT sponsored Prestel computer network and thought Prestel might be usable to create an electronic market. He discussed this informally with other pig producers, who told him that they would be interested in a computer-based system. Taylor approached GEC Computers of Borehamwood, who produced the GEC 4000 computers used to run Prestel services in eleven countries (Yates-Mercer, 1985). Taylor was invited to Borehamwood to discuss his proposition with GEC. GEC said a Prestel system was feasible and said that they would produce it for £14,000. Taylor went ahead on this basis and then approached abattoirs and producers to use the system. While developing TABROTEC Taylor became aware of CALM through seeing a video of the system and saw articles describing the systems in use in North America. The first sale of 300 pigs was held successfully in September 1986 with three abattoirs connected. Pigs were described by a statement of the historical performance of the particular producer. Where a lot was outwith a 5% variation from the historical average the buyer and seller would negotiate a compensation. The auction operated as a Dutch auction, with the offer price falling a penny per kilogram dead-weight every fifteen seconds. TABROTEC operated for three years, with the number of pigs sold each week never rising above 500 and the number of buyers never exceeding five. Taylor sought to franchise the system to livestock auctioneers, but they said that they found it too advanced for its time. Taylor found that buyers resisted using the system because it limited their scope for "wheeling and dealing". On one occasion he had to ban an abattoir from the system who was approaching sellers directly to by-pass the electronic auction. As a small player in the industry he found he lacked the influence to discipline buyers who abused the system, whereas later United Kingdom systems based around large livestock markets could give more credible threats. (JT)

In 1984 the Information Technology division of British Leyland, British Leyland Systems, became the independent systems company, Istel. Istel operated a nation-wide data network which they exploited by offering a national videotext service, Infotrac. Istel targeted developing videotext-based services for industries, linking firms with their customers where there were large volumes of information and a dispersed customer base, including Hotpoint and ICI Pharmaceuticals. One of these systems was a service, Agviser, operated by ICI Agricultural Division in Billingham, to provide videotext information to farmers. In 1981 ICI's Fertiliser Sales department developed an internal viewdata system. In 1983 ICI set up a team to market Agviser as a service available to external users. Agviser included access to agricultural

information and the downloading of farm management software. In 1985 it was planned to extend it to include access to a central database (DTI, 1985). ICI sold subscriptions to farmers and Istel charged ICI for system usage. Istel's experience with Agviser gave their distribution division an insight into the structure of the agriculture sector. Istel commissioned a survey in 1984 which concluded that the application of electronic commerce in agriculture would be attractive because of the large number of geographically dispersed farmers. They were aware that electronic marketing systems were operating in Australia. Ray Heath investigated the institutional structure of the livestock industry and saw parallels with the manufacturing and distribution sectors that they were more familiar with, in particular the use of information technology to track products, in this case animals, through the supply-chain. John Leafield, the managing director of Istel, employed an international management consultant, Vinoo Iyer, to advise on strategy. He introduced Istel to Michael Jenkins, who was a wealthy Welsh farmer. He explained to Istel that retailers could not trace back the meat which went on their shelves to find out who produced it or the breed of animal. Ray Heath went to Smithfield Show and Jenkins showed him that there was little correlation between live animal judging and carcass judging. They also went to the Royal Agricultural Society where they saw the lack of automation in maintaining pedigree registers. Istel developed a proposal for applying information technology to the livestock industry, including the machine-readable tagging of live stock and their tracing through the markets. The proposal was to set up a company to operate the system which would trace stock, use EDI to replace paper transactions and introduce electronic auctions. The auctions would be run by existing firms of auctioneers. Vinoo Iyer said that to launch the system Istel should enrol a past Minister of Agriculture (RH). Istel set up a company, Agricultural Products Commodities Exchange, using BT's public data network (Pearce, 1994). In 1988 a meeting was organised in London by Istel with representatives of auctioneers and meat companies. Istel were planning to launch their own livestock auctioning system and viewed the meeting as a means of sounding out the attitudes of the industry. Pam Harman, the Istel manager of the project had visited Jim Wideman at OLEX in Canada and Gardner at CALM in Australia. The meeting in London was attended by Chris Smith of the Meat and Livestock Commission (MLC), and Mike Sobey, the finance director of ANM Group who were planning to licence the OLEX system for use in the United Kingdom. For Sobey the meeting was useful in identifying the level of interest in electronic auctioning in the United Kingdom and, more specifically, bringing them into contact with F Yeo, one of the speakers who at that time was working for Kibble and Sons in Devonport (FY), and James Stephenson of Stephenson's & Sons of York. Sobey suspected that Istel "were deluding themselves about the size of margins in the livestock industry" and that the thin margins in the industry would make the type of system proposed by Istel unviable. Istel's initial approach to the livestock industry was to operate a system for the industry, but when they realised that ANM would

be going ahead with licensing the OLEX system they promoted their network as the system's communication medium (CS). Ray Heath believed that Istel had underestimated the social importance of market attendance for farmers and that the distances involved in the United Kingdom were much less than in the United States or Canada. He also said that there were difficulties in developing a fee structure for the system. According to Sobey, Istel were finally dissuaded from going ahead with a livestock marketing system when they realised ANM were taking a licence for the OLEX system: "we beat them to it - they were determined but we tied up participants" (MS).

John Taylor, the developer of the TABROTEC pig auction, worked as a consultant to Istel, and was on the point of joining Istel to set up their system, having agreed a contract, when Istel shelved their interest in agricultural commodities marketing when they were taken over by AT&T in July 1989. According to Taylor, the software was being developed by a system developer based in Nottingham, and was "60 to 80% written", with a demonstration held in Nottingham. Istel's auction was, according to Taylor, very similar to the following United Kingdom. Istel were planning to set up a network of auctioneers operating system franchises and were planning to spend £3 million pounds on launching the system (JT).

The introduction of electronic marketing in North America and Australia was known to small number of people in the United Kingdom who read foreign agricultural journals. In 1984 John Martin, a partner in Hobbs Parker, a long established firm of chartered surveyors and auctioneers, based in Ashford, Kent, toured the United States and Canada investigating developments in the marketing of agricultural products. This study tour was funded by the Nuffield Farming Scholarships Trust. On his return to the United Kingdom he wrote a report (Martin, 1984) and spoke at a meeting of the Livestock Auctioneers Association (LAA) on the emergence of electronic and satellite marketing in North America. Martin concluded that video auctions might have a role in the United Kingdom for remote producers of store stock, in particular cattle, where it would save the cost of transporting stock to distant markets. This was counterbalanced by the small size of the lots being sold making videoing less attractive. Martin noted that experience in the United States and Canada had demonstrated the feasibility of electronic auctions but that their impacts had been negligible. He saw electronic auctioning as being more suited to slaughter stock than store stock due to the existing carcass classification system. The variation of quality levels within the United Kingdom was identified as a barrier to their use. Martin claimed that electronic auctions would be of particular benefit in the United Kingdom pig industry where 88% of pigs were being sold directly by producers to processors, but added that greater use of computers and falling telephone costs would make electronic selling inevitable. Martin's report concluded by stating that "*the auction system will survive in the United Kingdom, but that its present operators will have to adopt the technological developments already proven in the United States and Canada.*" The attendees at this seminar, mostly representatives

of established auctioneers suffering from a drift in market share to direct buying, would therefore have been given the impression that electronic auction would halt this drift and that it was inevitable that someone would introduce them. The interest aroused by Martin's tour of North America led to a wider interest in the potential of electronic and satellite selling to halt the decline in physical markets. In May 1988 Chris Smith, an auction market specialist at the Meat and Livestock Commission (MLC), went to Canada to look at the OLEX system (CS). In 1986 Frank Yeo, a partner in a Devon auction company, visited North America to study livestock marketing. During this visit he saw the OLEX system in Ontario. *"It was three years into its development and it seemed to be working quite well in a difficult market"* (FY).

## EASE

In 1988 Aberdeen Northern Marts (ANM) was a large agricultural co-operative based in Aberdeen, Scotland, operated live markets in the North-east of Scotland and Premier Meats, a meat processing operation(EG). John Lind, at that time chief executive of ANM Group, first became aware of electronic marketing in 1985 through a conversation with a farmer from the Black Isle, Rosshire, who was an acquaintance of a person on the board of CALM in Australia. David Wright, the chairman of CALM, visited ANM when on a visit to Europe to study electronic auctions in the Netherlands and to assess the potential for selling CALM to operators in Europe (PDW)<sup>32</sup>. Lind learned about the OLEX auction system from attending John Martin's presentation to the Livestock Auctioneers Association (JL). ANM were therefore aware of electronic livestock auctioning systems overseas.

Lind believed there was an opportunity to develop a system in the United Kingdom for electronically marketing prime stock (stock for slaughter). Across the United Kingdom 50% of cattle were being consigned directly from farm to abattoir with 50% going through live auction markets, but in Aberdeenshire the proportion going through live auctions had fallen to 20%. Locally this trend was traced by Lind back to the outbreak of foot and mouth disease in 1960 which forced farmers and abattoirs to bypass the physical auctions due to restrictions on animal movement. As meat processors, ANM bought stock for slaughter direct from the farm and it was believed by Lind that farmers were receiving lower prices in direct sales. Lind believed that the operation of an electronic market would provide the co-operative's members with an alternative sales channel and higher prices than they could achieve by dealing directly with abattoirs, seeing electronic auctioning as a means of stemming the drift from live auctions to

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<sup>32</sup> According to Lind, ANM believed that Wright was on a purely social visit to Scotland. During this visit he also visited the Meat and Livestock Commission, leading them to approach auctioneers including Stephenson of York, to assess their interest in licensing the system in the UK

direct farm buying. *“Far from undermining the traditional auction system, the electronic auction has the potential to enable participating auction companies to considerably expand their business. In our own case, we see the 75% of finished cattle which are sold direct to the abattoirs at present as one of our main targets. This will bring back into the auction system, albeit the electronic auction, stock which have been lost to the directly consigned market over the years”*(Gillanders, 1989).

To evaluate in more detail the potential for setting up an electronic auction system in the United Kingdom, Sandy Wright, ANM's general manager, went in late 1988 to Texas A&M University to discuss the CATTLEX system and to Ontario to see the OLEX system in operation. Sandy Wright and Mike Sobey of ANM and B Revell of the Scottish Agricultural College (SAC) went in January 1988 to Sydney, Australia, to see the CALM system. The CALM system was seen by them as being too complex for the needs of ANM and negotiations were initiated to buy the rights to the OLEX system. Alex Hay, ANM assistant general manager, and Mike Sobey subsequently went to Ontario as a proposal to licence the OLEX system was negotiated. At this time, in 1988, ANM had sold their city centre auction site in Aberdeen to developers and were relocating to a purpose built auction facility at Inverurie west of Aberdeen. There was some resistance amongst the directors of ANM to an involvement in electronic marketing because they saw it as being contradictory to be investing in the most modern physical auction in the United Kingdom, while at the same time investing in a service which seemed to be in direct competition with the live market. Lind persuaded them that the electronic market was complementary to the live auction because it would extend their operations across the country and would be more directly in competition with direct sales. Following the assessment of the competing systems, ANM bought the United Kingdom rights to the OLEX system and an option for the European rights in spring 1989. ANM named the system EASE (Electronic Auction Systems Europe). (EG)

### ***Building the EASE Network***

The decision was taken by ANM to franchise the operations of EASE outside their own area. ANM started operating the system in 1989 then signed up franchisees progressively across Great Britain until they had a network covering the whole mainland by 1991. The LAA presentation in London on electronic marketing at which Martin described the North American experience of electric marketing and its potential benefits had generated a great deal of interest amongst auctioneers. ANM approached auctioneers across the United Kingdom seeking to create a national network of franchisees and held a demonstration of the EASE system for potential franchisees in BT's offices in Aberdeen. Franchisees were offered a three year exclusive franchise to operate EASE in a defined area. Franchisees would have to invest between £2000 and £3000 on hardware. Franchisees contracted to pay ANM a commission on electronic sales (0.2% of turnover),

with an agreed target throughput sales level setting a minimum payment to EASE. The terms for each franchise were the same except for the target sales level which was affected by the size of the market in the franchise area (EG). ANM was negotiating with a mix of existing auctioneers, who saw electronic marketing as an addition to their existing marketing methods, and individuals who were so convinced of the future success of electronic marketing that they would set up new companies to operate EASE franchises.

ANM sold the concept of EASE to auctioneers by claiming that if they did not set up auctions in their area someone else would. ANM could stress that the use of the systems in the United States and Canada showed that they were technically and commercially viable, quoting that 139,999 lambs and 99,646 slaughter cattle that were marketed by OLEX franchisees<sup>33</sup> (Gillanders, 1989). Gillanders, ANM Group marketing director, believed that ANM's decision forestalled the setting up of a system by a third-party, presumably Istel, and implied that the existence of EASE would forestall the emergence of any competing systems: *"Others have recognised the potential and had ANM not taken the initiative to acquire the European rights to the OLEX system, there was a real danger that it could have landed in the hands of non-auctioneering interests and this could have posed a real threat to the existing business of all auctioneers."* (Gillanders, 1989)

The process of signing up franchisees was delayed in early 1990 by a group of potential franchisees resisting the terms set by ANM. ANM were negotiating individually with potential franchisees. *"One of them wasn't very happy with the terms that we were offering so he pulled all the others together and tried to beat us over the head. I will always remember the date of that particular meeting, it was on the 1<sup>st</sup> of February 1990. They had met the day before and had agreed the strategy for the meeting with us and left this chap to be their spokesman when we met him and then he had changed the goal posts so they all lost confidence in him and we finished up signing them all up individually in the end, except this one individual, who you will probably guess is James Stephenson."* (E. Gillanders). (EG) James Stephenson and Sons are the family owned firm which operate the livestock market at York. ANM had first become aware of Stephenson's interest in electronic auctioning when M Sobey of ANM met James Stephenson at the Istel presentation on electronic marketing. Stephenson & Son entered into negotiations with ANM which lasted seven months and covered conditions of sale and methods of sale. Stephenson's concern was ANM's decision to own the system and operate it under a series of franchise arrangements. Stephenson

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<sup>33</sup> Perversely, considering that ANM claim that they were unaware of the NEMI system, these figures aggregate NEMI and OLEX sales.

wanted a partnership structure with everybody working together. Stephenson proposed that ANM franchise the operation of the OLEX system in England to a consortium of English auctioneers. In part this was because there was a mechanism for co-operation between English auctioneers, the LAA (Livestock Auctioneers Association). R. Pearce, of Stephenson & Son, believed that ANM were unenthusiastic about a more co-operative structure because ANM saw a great future for EASE and wanted to be at the centre of it. R. Pearce believed that ANM's proposed use of a compensation grid with premiums and deductions for variations from the par fatness and conformation grades was too heavily influenced by the abattoirs(RP). Stephenson & Son also objected to the amount ANM were going to charge for the use of the system, a guaranteed fee of £25,000 per year for the Yorkshire franchise. The total commission rates were to be 2.5% on cattle and sheep and 2% on pigs. Franchisees would then pay ANM 0.2% of turnover. In the end the Yorkshire EASE franchise was taken on by Colin Young, who had been responsible for the early operation of EASE in Southern Scotland when managing director of Lawrie and Symington of Lanark. After being fired by Lawrie and Symington in October 1990 he set up his own company, Ease-in-Wold, based in Easingwold, North Yorkshire to operate the EASE franchise in July 1991.

United Auctions (UA), Perth, looked at electronic livestock auctions in 1985. They were aware of the Ontario system in Canada. In 1988-89 UA were approached by ANM and became EASE franchisees in early 1990. They used EASE for selling prime cattle and sheep and were also members of a partnership within EASE to market grain: *"We felt that grain is easily described"* (DL). They tried to run it for two seasons, but then it was abandoned. UA specialised in using EASE for prime cattle: *"We had quite a lot of success for about three years then a combination of circumstances - a good chap left, we took on someone else who didn't quite fit, so we had a bleak period."* Their maximum scale of operations was three salaried fieldstaff, but by 1996 it had been reduced to one salaried person with support from auction staff. According to Leggatt, while in EASE *"the franchise holders recognised the fieldsmen as the crux of the whole business"*, but UA's sole fieldsmen started as a secretary.(DL)

In 1989/1990 Frank Yeo, the West Country auctioneer who had visited Canada to see the OLEX system in operation, approached ANM to become an EASE franchisee. He set up West Country EASE as an EASE franchise covering the South West of England. Yeo was an EASE franchisee for two years. Yeo argued that being tied to specific boundaries was a weakness of EASE: *"the level of commitment was different in virtually every sector."* Seven of the EASE franchisees were auction companies and three were individuals.

Nine franchises were established, six in England and three in Scotland (EG).

**Table 6: EASE Franchisees**

North of Scotland	Aberdeen & Northern Marts	Inverurie
Central Scotland	United Auctions	Perth
South of Scotland	Lawrie & Symington	Lanark
North of England	County Auctions	Wooler
Yorkshire	EASE-in-Wold	Easingwold
Midlands and East Anglia	Midland Electronic Auction Team Ltd	Rugby
Wales & West	Wales and West Computer Auctions	Hereford
Wessex	Alder King	Chippenham
South East England	South East Marts	Guildford
West Country	West Country EASE	Lydford, Devon

All the franchisees, except EASE-in-Wold, Midland Electronic Auction TEAM and West Country EASE, were existing livestock auctions. Yeo argued that the individuals who entrepreneurially set up franchises had greater commitment than existing auction companies who operated the electronic auction in parallel with their live markets: " *Some of the auction companies.... .... bought the system to protect their area.*" (FY)

### **Technology**

The EASE auctions were run using a DEC VAX server located at ANM's headquarters in Inverurie linked to subscribers through BT GNS (Global Network Services). Users connected to the BT Network using BT Dialplus, an asynchronous X28 dial access service launched in 1989 with 90 nodes providing 90% local call access across the United Kingdom at access speeds of 2400bit/s. Dialplus upgraded to 9600bit/s in 1992, 14400bit/s in 1995 and 34 sites are planned to operate at 28,800 bit/s by the end of 1997. In 1997 Dialplus operates with 130 local access numbers across the United Kingdom allowing connection at speeds between 300 and 14400 bit/second. The EASE host computer was connected to the BT network using BT X25 Direct, the BT X.25 synchronous dedicated access service, which allows exchange at up to

64 kb/s.<sup>34</sup> The maximum number of buyers connected to the EASE auction was 35, with the server having the capacity to handle 50 connections. GNS rates in 1992 were £1.84 per hour, with a fee of £5 per hour to log onto the system (Taylor et al., 1992). In their publicity EASE claimed that franchise fees were not significant, describing the sum paid by the franchisee as being “*minimal... ... for the privilege of holding an exclusive franchise*” (Taylor et al., 1992). In the EASE accounts filed for 31<sup>st</sup> December 1990 the company’s total tangible assets are valued at cost as being £274,523, which will almost wholly comprise the cost of hardware and software. Technical responsibility for the system was taken on by Ian Hay who was trained on the operation of the system by OLEX in Scotland. He then trained the EASE franchisees and the meat companies on how to use the system (IH). To operate the system EASE Ltd employed a full-time general manager and a part-time marketing manager (Taylor et al., 1992).

In the EASE system ownership of the livestock passed to the abattoir at slaughter, but the purchaser was responsible for the stock from the time they were uplifted (EG). When established EASE commission was 1.25% with payment within 14 days of slaughter (Gillanders, 1989). United Auctions of Perth charged 2.5% for cattle on the EASE electronic auction compared to 3% in their live auction, but in the live auction the farmer is paid on the day rather than having to wait a fortnight (DL). The commission was paid by the vendor and the buyer paid for the transport from the farm to the abattoir. Historically the practice with pigs and cattle sold directly is for the farm to deliver to the abattoir. Leaving the organising of transport to the abattoir allows the abattoir to assess the transport cost when bidding. In the electronic auction the farmer cannot control whether the lot is bought by an abattoir hundreds of miles away or next door. In Canada more complex terms for apportioning transport costs were seen but rejected by EASE. Making the abattoir responsible for transport created a barrier to the adoption of the system by abattoirs who saw this as an additional cost. (EG)

### **Grading**

EASE followed OLEX in using bids in pence per kilogram dead-weight, with corrections for variations in carcass grading. Animals slaughtered in the United Kingdom must be weighed and classified after slaughter, so dead-weight selling using the abattoir classification of the carcass did not require additional weighing or carcass inspection, whereas live-weight selling would have required stock to be weighed when uplifted. The MLC have been supplying carcass classification services in abattoirs since the 1970s. For beef and sheep a two dimensional grid is used, classifying carcasses into one of five conformation grades, determined by visual appraisal of shape (E, U, R, O & P), and into five main classes for fatness,

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<sup>34</sup> The X25 standard was defined in 1972 by CCITT, providing access to data networks at rates up to 64Kbps.

determined by an appraisal of external fat development ( 1 (very lean) to 5(very fat), with classes 3 and 4 sub-divided into L(leaner) and H (fatter)) (MLC, 1996). The classification of beef carcasses was mandatory across the EU from January 1992 and the classification of sheep carcasses was mandatory from January 1997 (MLC, 1995).

An intervention system not based on carcass classification is open to the moral hazard of producers directing their lowest quality carcasses into intervention. The EURO grid has two dimensions: conformation and fatness. For beef carcasses conformation is divided into five main classes E, U, R, O and P, with the U, O and P sub-divided into upper and lower bands. Class E describes carcasses of “outstanding shape”, while at the other extreme P represents “poorly muscled carcasses of inferior shape”, usually produced by cattle from dairy breeds. Fatness is divided into five classes from 1, which is “very lean”, to 5, which is “very fat”. To aid the understanding of the classification system the European Commission produces photographs with examples of each conformation and fatness level. When a carcass is inspected by an MLC inspector it is graded for conformation and fatness. The most commonly expected class of beef cattle is a carcass with an R grade for conformation and a 4L fatness level, described as R4L. Bidding in the EASE electronic auction was based on a carcass classified R2 - R4L for cattle and R2 -3L for sheep with predetermined premiums for carcasses classifying E or U and discounts for poorer quality and over-fat carcasses. For pigs on the EASE system bidding was on the basis of the highest grade determined by probe measurements with discounts for over-fatness (EASE, Inverurie, 1991).

The feasibility of predicting carcass grades from a visual inspection of the live animal was demonstrated in a survey of producers, buyers and market prices undertaken by Aitken and Crosby (1984). The study involved two researchers assessing over 30,000 cattle passing through live markets and comparing these to the carcass grades achieved after slaughter. The results showed a high reliability of assessment, from which they deduced that classifying live cattle to the European carcass classification system could be undertaken by producers. Aitken and Crosby also argued that involvement in carcass classification would provide farmers with better information about the needs of the abattoirs. They found little evidence that producers were aware of the precise needs of buyers, particularly their preferences for conformation and breed. They also found evidence that the reported procurement policies of buyers was not reflected in the actual market, with buyers claiming a preference for cattle weighing 450 kg which was not supported by an analysis of market prices.

Following OLEX, EASE introduced a grid based mechanism for compensating for variations in carcass classification. On sheep the bid was based on carcasses graded R2 - R3L and on cattle was based on carcasses graded R2 - R4L. The price per kilogram was reduced for carcasses grading worse on

conformation or fat, with premiums for carcasses which graded better. The use of the grid was the idea of ANM managers, but they liaised with buyers to set the deductions/premiums. The compensations were developed by ANM in the case of cattle and County Auctions, the EASE franchisees in Northumberland, in the case of sheep based on known variations in dead-weight prices and discussions with abattoirs.

According to Gillanders of ANM, the main problem in setting up the EASE system was unreliability in carcass descriptions. The importance of accurate livestock classification for both producers and buyers was recognised: "*Classifiers will obviously require to be sound judges of livestock and we believe that with training in live/dead assessment at MLC's training school at Manchester and day-to-day experience, a high degree of accuracy can be achieved*" (Gillanders, 1989). EASE fieldstaff were all trained to classify stock according to the MLC grid (EG). The fieldstaff in the EASE franchisees came from a variety of backgrounds: ex-MLC graders, auctioneers and meat company buyers. Of these the ex-MLC graders were found to be the most reliable assessors but "*often tended to be not very commercial*". The payment of EASE fieldstaff varied. In the early days most were salaried, but after the first year when the volumes traded were not as high as expected franchisees moved to using either part-time staff or staff paid on commission (EG). The fieldsmen assessed the stock on the farm and predicted the fat and conformation levels of the slaughtered carcass using the MLC Europe classification grid. At the start of electronic selling there was a tendency for the fieldsmen to grade stock too highly. When killed and graded to a lower level neither the abattoir nor the farmer were happy: while the abattoir received a price discount they would not have the grade of carcass they expected and the farmer would receive a lower payment. Inaccuracies in carcass assessment was a problem for abattoirs, particularly for buyers with very precise requirements, which included those meeting export contracts and those buying specifically for the Beef Intervention Scheme. Abattoirs felt that the discounts for cattle graded O+ and O- were not sufficient to compensate for the poor quality (Christie et al., 1991).

### *EASE in Use*

The first EASE electronic livestock sale was conducted on November 14 1989. Eight Simmental cross steers were sold by John Morrisson, Newton of Auchaber, Forgue, Huntly for 222p/kg to Alsop of Aberdeen (Gillanders, 1989). On November 16 EASE sold 450 tonnes of barley and wheat in their first grain sale and their first sheep sale was in 1990. Initially it was expected that cattle sales would be more successful than sheep sales because sheep were believed to be more difficult to describe accurately and the subsidy regime made live sheep sales attractive. At that time sheep could be taken to the live auction and inspected by MAFF inspectors. If the sheep did not meet the subsidy criteria the farmer had the option to take them back, whereas if they went direct to the abattoir the carcass would be inspected, in which case

it would be too late if they did not meet the specification. In 1991 the subsidy was transferred from the prime lambs to the breeding ewes, making dead weight selling of lambs more attractive and less risky for farmers. After 1991 the electronic selling of lambs became more significant. While most abattoirs employed fieldstaff to purchase cattle direct from farms, their systems for procuring lambs were less well developed. Assessing lambs for fatness and conformation is a time consuming activity, so allowing the electronic auction companies to undertake this activity was attractive to abattoirs (EG).

David Leggatt of UA, Perth, the EASE franchisees for central Scotland, claimed that electronic selling was suited to particular types of animal, particularly Charolais bullocks and bull beef in groups of at least four. According to Leggatt, UA learnt that electronic sales replaced live sales rather than direct sales, which explains UA's lack of commitment to electronic selling (DL). Leggatt also had learnt that the electronic system was open to abuse from free-riders: "*you transmit your customer list to every point of the United Kingdom and other electronic companies or dead weight companies come in and try to pinch your stock.*"(DL). Two abattoirs were blacklisted by UA for this. (DL)

### **Marketing**

To enrol users of the system EASE contacted the major abattoirs. To persuade farmers to sell their stock electronically EASE used local meetings, promotional literature and advertising in trade journals. In 1990 EASE spent only £50,000 on promoting the newly launched system, most of which was spent at agricultural shows. After 1990 EASE promotional spending was cut-back centrally and marketing efforts were left largely to individual franchisees (EG).

A group of postgraduate students studying for diplomas in Farm Business, Organisation and Management (Dip FBOM) at the Scottish Agricultural College, Aberdeen, carried out a study of EASE in 1991 (Christie et al., 1991). Christie et al. carried out a telephone survey of abattoirs and farmers. In 1991 approximately 150 farmers and 30 buyers were using EASE each week across the United Kingdom, with 15 farmers selling through EASE in Inverurie. Christie et al. reported that in 1991 EASE's long-term objective was to sell 1900 cattle per week, a level which was never achieved. Their study found that average prices per head on EASE were higher than the Scottish average by 0.3 p/kg for heifers and 5.35p/kg for steers., but that this apparent price difference was due to the average conformation of stock sold electronically being higher than the national average. They estimated that selling electronically was saving farmers £2.50 per head in transport costs. Of the forty farmers surveyed by Christie et al., eight had sold through EASE, 29 were aware of EASE but had not used it and three were unaware of EASE. The main advantage of using the electronic auction cited by farmers was the higher prices, followed by the reduction in sales

commission, with time savings and haulage cost reductions seen as being less important. The main problem cited was inconsistency in carcass classification. Of farmers who were aware of EASE but not using it, 21 of the 29 were selling over 66% of their stock direct to abattoirs, with only 5 selling over 66% through auctions. While EASE stressed the benefits of electronic selling relative to live markets, it was direct farm buying by abattoirs which it needed to target. At its inception E Gillanders had described the strategic aim of EASE as being halting the drift to direct buying, but the marketing effort, concentrating on its cost benefits over live markets, was not consistent with this strategy. The abattoirs surveyed by Christie et al. identified the main benefit of EASE use being a source of stock to top-up their other sources of supply. This topping up was most useful in May and June, when there was a gap between the end of cattle finished in-doors being sold and the appearance of cattle finished outdoors on grass, and December, when there was a high demand for beef at Christmas (Christie et al., 1991). This use of EASE by abattoirs to source additional stock should have raised concerns, as it ran counter to the vision of buyers sourcing almost all their stock electronically and would place a low ceiling on the potential market share of electronic markets. However, the significance of this was overlooked by Christie. Four of the six abattoirs who responded predicted that EASE's market share would not exceed 20%. The attractiveness of EASE was seen as being closely linked to the future of the Beef Intervention Scheme: if the intervention price was reduced use of the system would become more attractive to abattoirs but conversely less attractive to farmers (Christie et al., 1991).

A further study of EASE use was undertaken by Grega and Ray (1992) using an analysis of prices achieved on EASE between September 1991 and February 1992. Comparing the EASE average prices to the MLC reported dead-weight prices, EASE prices were 1.54 p/kg higher for steers but 1.75p / kg lower for heifers and 0.39 p/kg lower for young bulls. These figures underestimate the attractiveness of electronic selling to producers because in dead-weight selling the producer would also have to pay for the transportation in direct dead-weight selling, estimated as 1.2 p/kg by Grega and Ray if the cattle were to be transported fifty miles. Grega and Ray also found evidence that the EASE price followed the previous week's dead-weight price (Grega & Ray, 1992).

In August 1991 Farmers Weekly reported (Burns and Robertson, 1991) that the price premiums for trading on EASE had fallen in the first year of its operation. A farmer in Scotland producing 700 head per year was quoted as saying: *"Last year the abattoirs were obviously trying to keep the price as low as possible. I ended up by putting 200-250 head through the electronic system and I would think that I got up to 10p/kg more than the market. But this year the electronic market seems to be about 3p to 4p behind the market and I haven't been tempted to use it"*. This demonstrates both the strength of the electronic market's transparency but also the danger that this will inhibit buyers from using it.

### *Other Products*

There was a belief when EASE was established that pigs would be an easy commodity to sell electronically because they display less variation than sheep or cattle. However, they tended to be sold by well established producer groups direct to abattoirs. One EASE franchisee, South East Marts of Guildford, developed an electronic pig trade, but still sold fewer than 1000 pigs per week. Pig prices on the EASE auction were found to be higher than the market price, but they suspected that this was due to abattoirs using the electronic market to balance their throughput (EG).

ANM and the other EASE franchisees were aware that the system could be used to auction almost any product, not just livestock. Beyond livestock, the next commodity considered by EASE for sale electronically was grain. Grain was produced by farms with whom auctioneers were in contact, but unlike livestock, grain trading in the United Kingdom has historically been traded by grain merchants rather than auction companies. One of the first EASE sales was a grain sale, but grain sales only formed a small proportion of EASE activity because of the low margins charged by existing grain intermediaries (EG). EASE have also sold milk quota, the allowances for farmers to produce milk. The electronic selling of milk quota gained an impetus when the demise of the milk boards removed the restriction on quota being traded only within milk board areas, creating a national market. In milk quota sales it is farmers who are both selling and buying milk quota. The EASE franchisees set up terminals to allow farmers to come in and bid, or they could connect using a modem and their own personal computer.

A similar approach was adopted by United Auctions, Perth in setting up deer sales under the aegis of the British Deer Farmers Association. The association had organised sales of deer calves at Perth market. Relative to other domesticated livestock, deer are nervous animals that are adversely affected by being transported to a market. The calves are sold from breeding herds, often in Scotland, for finishing on grass. The British Deer Farmers Association developed a basic description system for deer which was used in the electronic sales, including the age, sex and weight of the deer. Where weights differed from the stated weights when the loads were weighed at a weighbridge after collection, corrections were made. If the discrepancy was large the purchaser had the option to refuse the lot (EG). Electronic auctions were held in 1991, 1992 and 1993 using the EASE system. Between 1000 and 1500 deer were sold each year, in either one or two sales (a deer calf sells for approximately £80). Potential buyers would either go to their local EASE franchisee to bid or would bid by telephone to an EASE franchisee. Peter Stoeken, chairman of the British Deer Farmers Association, who was responsible for the electronic selling, sees the benefit as being the market transparency. The organisation of the sale was aided in his opinion by the relatively small number of farmers in the deer farming community, with the British Deer Farmers Association having 250 members and there being approximately the same number of non-member deer farmers. Stoeken is looking

at restarting electronic selling in November 1997, but is looking widely at alternative methods of linking buyers and sellers, including the Internet, rather than use one of the existing livestock auction systems (PS).

In 1992 ANM set up EASIGOE to sell surplus oil equipment using the EASE system. ANM had experience of auctioning plant and equipment and realised the potential of selling redundant surplus plant to oil companies world-wide. Specialist personnel were recruited from the oil companies to run EASIGOE. In 1995 its turnover was approximately £5m. Auctions were held approximately every fortnight. Agents have been appointed to represent the system overseas, with offices in Dubai and Singapore. EASIGOE has over 200 subscribers. Only 30% of sales are through genuine auctions, for the rest the system is used to communicate items for sale. (EG) EASE also investigated using the system to sell endowment policies, cars and flowers, but none of these ideas became operational (EG).

In 1989 EASE lost £51,000, followed by £251,000 in 1990 and only £36,000 in 1991. John Lind, the chief executive of ANM Group when EASE was established, accepted that when EASE was being set-up ANM had underestimated the cost of establishing a force of fieldsmen and had overestimated the system's rate of growth. In particular they had wrongly estimated the number of cattle which each fieldsmen would be able to source for the system. In the first year each franchisee achieved their expected level of sales, however the market then flattened out. According to Lind, the ability of ANM to carry-out a detailed analysis and develop a more detailed strategy was restricted by the upheaval of moving their base from Aberdeen to Inverurie at the same time. In addition, the predicted rate of decline of live markets had been less than predicted by ANM. John Lind assumed that in the long-term 70 - 80% of stock would eventually be sourced directly, with electronic auctions taking the predominant share of the remaining 20 - 30%. Gillanders claimed that the emergence of competing systems was expected because EASE's franchise structure excluded most auctioneers and during the setting up of the EASE network a number of auctioneers became interested in electronic selling but were either unable to take up an EASE franchise or were unwilling to accept ANM Group's terms. (EG) However, it is unlikely that the appearance of another four auction systems plus a satellite video auction during 1992 was expected when ANM invested in EASE.

Frank Yeo, the EASE franchisee in the South West of England who was the most successful in terms of the numbers of stock being sold<sup>35</sup>, broke his contract in 1992 and started operating for the rival APEX auction system, although it was suggested that this was to avoid bankruptcy. The next most successful EASE

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<sup>35</sup> in June 1991 South West EASE was selling 350 - 380 cattle per week and 1800 lambs (Burns and Robertson, 1991)

franchisee, County Auctions in the North East of England, decided to set up their own DIRECT system in 1994, having given the required six months notice. However, other franchisees found making a success of EASE more difficult. A third franchisee, Midland Electronic Auction Team Ltd, operated by Duffy in Rugby, went bankrupt in December 1992, owing over £60,000. He had taken on a large franchise covering East Anglia and the Midlands, having been a partner in Hawkins and Harrison, the operators of Rugby Market. According to Lind, Duffy was undercapitalised and focused on selling pigs electronically, which was found to be very difficult. He also had a lack of experience in the livestock trade, being described as “*more a surveyor than an auctioneer*”, and after suffering several bad debts went bankrupt (EG).

## **BEACON**

James Stephenson of Stephenson & Son of York, having attended the early presentations by Istel, MLC and LAA on electronic livestock auctioning saw that it could be a means to arrest the decline in live auctioning. Sheep numbers sold through live auctions had fallen due to the ending of the variable premium scheme, although cattle numbers were increasing. The abattoirs had made a strong effort to increase direct cattle buying in 1998, but many farmers were drifting back to live markets because of the risks of abattoir failures, the quicker payment from markets and mistrust of deductions made in dead-weight selling. This drift back to live markets continued until the BSE crisis of March 1996 (RP). Roger Pearce, the market manager at J Stephenson & Son, became aware of electronic marketing in 1988 when James Stephenson attended a discussion with the MLC on the possible use of CALM in the United Kingdom (RP). Stephenson could see the advantages of electronic markets in gaining a share of dead-weight trading. Shortly afterwards they learned of ANM’s decision to buy a licence to operate the OLEX system. Pearce described this decision by ANM as showing “*great foresight*”. He believed that the falling price of information technology, particularly the price of personal computers, would make electronic selling increasingly attractive. Stephenson entered into negotiations with ANM to take on an EASE franchise for Yorkshire. As discussed earlier they became dissatisfied with the franchise structure being proposed by ANM, which they felt left franchise holders with little control over the structure or development of EASE. Stephenson organised a meeting at York in 1989 of English auctioneers who were negotiating to become EASE franchisees to seek a common stand against the conditions proposed by ANM. At this meeting it was impossible to agree to take a united stand against ANM’s terms and Frank Yeo in the South West, David Brown from Chippenham, David Duffy from Rugby and George Forbes from Wooler decided to negotiate with ANM and became four of the English EASE franchisees. The remaining auctioneers at the York meeting agreed to co-operate to explore setting up their own system. Three of these auctioneers dropped out as the activities of the consortium became more formalised. A government grant was obtained

to define a specification for the software and write an invitation to tender for its development. It was decided that a network of eight auctioneers covering England and Wales would form a viable community. Large auctioneers were approached in areas not covered by consortium members and a consortium of eleven established auctioneers was formed in late 1989 as BEACON Auctions Ltd.<sup>36</sup> (RP).

The members of the BEACON consortium were Carlisle, Gisburn, York, Chirk in Clywd, Newark, Banbury, Norwich, Ashford, Neath, Hexham and Yeovil. Each firm invested £12,500 for an eleventh share of the company. Several of these members joined BEACON in response to the fear that EASE would become highly successful and that they would be left at a competitive disadvantage. For example, Ian Smethurst, the Managing Director of Midland Markets of Banbury, England's largest livestock auction, admitted that: "*As livestock auctioneers, we panicked in the autumn of 1989 when we felt our business was in danger of being swamped by electronic auction systems.*" Ian Smethurst did not like the EASE franchise system and Midland Marts became founder members of BEACON. (IS)

The BEACON consortium agreed fundamental principles: the electronic auction should mirror live auctions, producers supplying high quality should be rewarded with high prices, there would be no fixed additions and discounts, and BEACON should be equally owned by its participants. Auctioneers leaving BEACON must either sell their stake to another auctioneer acceptable to other members or their share be bought back. Unlike EASE, BEACON members were not tied to defined areas, except that they could not procure stock within 10 miles of the headquarters of another BEACON member (RP).

When BEACON was established promotional effort was directed towards encouraging farmers to sell electronically. The abattoirs were aware of electronic selling through the activity of EASE. Some abattoirs were using dumb terminals to bid on EASE, but most connected computers to modems to connect to the auction. In only one case did BEACON provide a computer as a trial, and this was later bought. To encourage farmers to use the system BEACON held a series of local meetings with literature and a slide show. Farmers still found the electronic marketing idea novel, but most had heard about EASE. They were found to be more concerned with the prices they would receive than with the technology. BEACON's aim was to develop long-term relationships with farms. If they contracted to sell a certain number of sheep over a year, BEACON offered them a discount paid at the year end if the volume was met. On the BEACON system livestock traders have realised they can buy sheep from auctions then sort them into larger more uniform lots and sell them electronically (RP).

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<sup>36</sup> Originally it was to be British Electronic Auction Company, but the DTI prevented BEACON using the adjective *British* in the company title.

BEACON Yorkshire did not employ full-time fieldstaff, but instead they employed freelance agents working for commission: *"The ones that have lashed out most money have failed"* (R. Pearce. In 1995 BEACON Yorkshire had one staff member who also worked in the office and four agents out procuring stock who received a guaranteed income plus commission. Almost all of these agents were from farming backgrounds: *"Most of them have some contact with farmers, they have to do, they have to know stock, but it is a skill that is teachable."* (RP)

When the BEACON consortium were planning the implementation of the system, seven companies were sent invitations to tender for the system hardware and software. It was believed by BEACON that the EASE system was outdated, linking dumb terminals via the Dialplus data network to a central machine. BEACON believed that the flaw in the EASE system was that because of delays in the transmission of bids over Dialplus, bids would not necessarily arrive at the central computer in sequence. In the BEACON specification bids were to be time-stamped so that the central machine could identify the true sequence. This required bidders to be bidding on personal computers running BEACON software, unlike on the EASE system where bidders could use dumb terminals linked by modem. BEACON also specified that the software would use a colour screen. The time sequencing of bids was particularly significant if the system was to be used for high value items, for example forestry contracts. Roger Pearce said BEACON had not looked at licensing their system elsewhere in the world. (RP) Ian Hay, who was responsible for the technical operation of EASE and then APEX, claimed that abattoir buyers found BEACON *"too flash and more than required... .. they weren't computer literate, they didn't know how to type."* (IH)

BEACON contracted with ASC Ltd, a software company set up for the purpose by staff at York University, to develop the BEACON system. BEACON continues to contract some development tasks, for example the restructuring of the system's communications software, to the same people under the aegis of Human Computer Interaction (York) Ltd. ASC advised BEACON on the hardware and the communications required for the system and developed the bidding and associated accounting software. The Sequent UNIX computer based at York Livestock Centre runs auctions for all BEACON members<sup>37</sup>. The Sequent is connected to BT-GNS by a 64k link allowing 150 users to be simultaneously connected. Bidders dial up through their local GNS port. Auctioneers in the eleven members also connect through GNS to run their auctions. (RP) In the BEACON accounts filed for 1991 the at cost asset values of software and hardware are £142,072 and £136,074, giving a total cost of £278,146, which is almost identical to the implied cost of £274,523 for EASE.

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<sup>37</sup> In 1997 it is planned to replace the Sequent with two dual-processor PCs.

Midland started using BEACON in 1991 with a designated area in the Midlands. However the practice of electronic auctioning did not meet their expectations: "*In those two years we could not make the BEACON system work in any way.*" Smethurst argued that the diagnosis of BSE in May 1990 gave EASE a boost as farmers sought alternative markets. Midland Marts was a very well established local market that had "a really good hold" on stock traded within 80 miles of Banbury. In justifying their membership of BEACON Smethurst admitted that: "*We did it on defensive grounds, it was purely defensive, and we sat there for two years I suppose without the level of commitment that would have been required to run with it fast enough.*". Smethurst admitted that Midland Marts misconceived its approach to BEACON. They aimed to use their staff in a dual role, offering to farmers the alternative between live or electronic selling, but this choice gave a "*confused message.*" (IS)

Relative to the other electronic auctions BEACON has been very successful in the selling of sheep. Pearce claimed that this was due to their operating methods. BEACON decided to not use a grid of premiums and deductions relative to the par fatness/conformation grades, as adopted by EASE. Instead BEACON use corrections specified by the seller in association with the assessor to compensate for overweight stock. R. Pearce claims BEACON's success is due to supplying stock close to the catalogue description. Like EASE, the BEACON system does not penalise producers withdrawing stock from a sale. (RP)

Roger Pearce was involved in an attempt to agree standard conditions for all electronic auctions but this "fell on stony ground". Contacts between auctioneers operating the rival systems existed through the Livestock Auctioneers Association, which has an electronic division, but this excluded franchise holders of EASE who were not traditional livestock auctioneers and auctioneers in Scotland (RP).

### ***Other Products***

BEACON members knew that EASE had attempted to sell grain electronically but had found it difficult. The grain market is controlled by a trading federation, UKASTA (United Kingdom Agricultural Supply Trade Association). While farmers saw a benefit in having a genuinely competitive grain market, the grain companies were less keen on auctioneers becoming involved in the grain market. When EASE went ahead and organised a grain auction the grain trading group threatened to "black" anyone who bought grain on their system. (RP) To overcome this resistance BEACON sought to build bridges with the grain industry. All grain in the United Kingdom is traded under UKASTA rules. While EASE went ahead without UKASTA agreement, BEACON applied to UKASTA to become members and formed a partnership with John Sawkhill, who had previously been general manager of Kenneth Wilson, a Yorkshire grain merchant, an ex-president of UKASTA and friend of James Stephenson. BEACON Grain held their first grain sale in September 1995. In a market survey BEACON found that most farmers sold grain locally to people they

knew, but in the electronic system BEACON have twenty buyers from across the country. The aim in 1996 was to hold electronic grain sales monthly. In the electronic auctioning of grain it is not necessary to carry out a detailed assessment because the seller takes responsibility for describing the grain. (RP) In 1995/96 BEACON Grain sold 9000 tonnes of grain, but the level of sales in the following year was much lower. Pearce argued that this fall was due to the price of grain falling almost continuously from September 1996 to July 1997 from £103 per tonne to £75 per tonne, with sellers unwilling to sell their grain electronically on a falling market.

BEACON also developed their system to run electronic timber sales. The traditional structure of the timber industry is for private producers to sell to local timber firms, with Forest Enterprise, the commercial arm of the Forestry Commission, the nationalised forestry corporation, selling their standings of timber by auction, tender or privately to the large timber firms. Timber was seen as ideal commodity for electronic selling because, for example with saw logs, once the species and length is specified, timber is a standard commodity sold by the cubic metre. The major difference between timber and livestock when auctioned by BEACON is that the catalogues have to be produced over a month before the sale and the description is provided by a specialist. Timber is sold as stands or cut logs, by the ton, the cubic metre or by lump sum. If it is sold for a fixed sum the description must be accurate, but the potential purchaser can still inspect it on site. (RP)

EASE and LEAN, another electronic auction system, both had electronic timber sales before BEACON's. R. Pearce claimed that their systems were both inherently unsuitable for auctioning timber because the sequence of the bids when bidding in £1000 increments is vital. He claimed that in the EASE and LEAN systems a bidder may believe they are bidding at one price but the bid be accepted at the next increment because another bid has passed it. BEACON held their first timber sale on 22 November 1996, with 23 lots from across the United Kingdom. BEACON developed special software to support the timber auctions, and established a separate brand, BEACON Forestry. (RP)

The BEACON member in South Wales led the setting up of a box meat auction, again with special software written. Box meat is the meat left over at abattoirs when they have taken away the cuts required by their principal customers. Traditionally abattoirs have marketed these off-cuts to other abattoirs. The size of the box meat market in the United Kingdom is £600,000,000 per year (RP).

## LEAN

Lysis are a computer software company based in Northallerton, North Yorkshire which specialise in supplying computer systems for livestock auctions. John Brickwood, the Lysis managing director, had seen

the paper prepared by Martin describing his study tour of North America and saw the potential for developing and operating an electronic livestock auction system in the UK. In 1988 Brickwood started the development of an electronic auction system, planning to franchise it to auctioneers. Stuart Thomson, managing director of Thomson, Roddick and Laurie of Dumfries, a traditional family-owned regional auctioneers based in Dumfries, first became aware of electronic auctions in 1990 when he read a description of the CALM system in a magazine. When ANM set up EASE, Thomson, Roddick and Laurie applied for a franchise, but the franchise for Southern Scotland had been awarded to Lanark. Thomson, Roddick and Laurie were approached by Lysis who claimed that the system they were developing was better than EASE, using a monochrome non-scrolling screen. Thomson, Roddick and Laurie were offered a three year contract to operate the system without being tied to a specified franchise area. Lysis had identified several auction companies who had been unable or unwilling to take on an EASE franchise and were not members of BEACON (JT). These auctioneers, including Thomson, Roddick and Laurie, were interested in using the system but were unhappy with the three year contracts proposed by Lysis and did not want control of the system to rest with a third-party. Eventually, in 1991, a consortium of auctioneers bought the software from Lysis. The consortium comprised Thomson, Roddick and Laurie of Dumfries, Henry H Bletsoe of Thrapston, Northamptonshire, North East Livestock Sales of Acklington, Northumberland, Southern Counties Auctioneers of Salisbury, Stratford-on-Avon Stock Sales Ltd and Northwest LEAN, a consortium of Cumbrian auctions (Wigton, Cockermouth, Penrith and Kendal). The system was originally named LEAN (Lysis Electronic Auction Network), and this name was adopted by the consortium because of its allusion to lean, healthy meat. The LEAN consortium members called themselves "operators".

Initially each operator's auctions were consolidated into two auctions: a northern auction and a southern auction. LEAN started trading in summer 1992, selling prime cattle and sheep. Thomson, Roddick and Laurie's LEAN auction is run by a general administrator who works across the firm's activities: "*The running of the auction is child's play.*" Thomson, Roddick and Laurie took on two full-time staff to procure stock. These fieldsmen came from a farming background: one a shepherd with abattoir experience, the other a farm manager. However, by 1995 Thomson, Roddick and Laurie was operating with two part-time fieldsmen. Whereas originally they were salaried, they were by then exclusively on commission, with fieldsmen being paid 40p per lamb. The MLC trained LEAN fieldsmen in carcass grading, but J. Thomson claimed that they started with a good understanding which was reinforced by the accuracy of their classifications (JT).

LEAN used the same Europe grid adjustments as EASE, except: "*we changed the outside square so that we hadn't pinched their square completely*". The improvement of LEAN over EASE was primarily that

the auctioneer saw the auction from a single screen with a single connection to the central computer. The LEAN system was also integrated into the accounting system to print out cheques and invoices. Thomson, Roddick and Laurie charge 2% on LEAN for cattle against 2.2% live for cattle, with lambs 2.5% on electronic or live (JT).

The LEAN software runs on a Motorola UNIX computer owned by Lysis and used by Lysis for other uses, with auctioneers and buyers connect to it using BT's Global Network. According to John Brickwood, the managing director of Lysis, the GNS X.25 network was adequate at first, but operating costs were high and they were suffering from data transmission delays. He was planning to go to 14.4 k direct dial-up connections. Lysis are paid a fee by the system users for running the software plus a commission. In theory LEAN could run the software using another firm's hardware but this is limited by the need to use a UNIX machine. Thomson, Roddick and Laurie pay Lysis £360/month to run the auctions. (JT) LEAN does not require bidders to run specialised bidding software, being able to run on dumb terminals. Unlike EASE the description of the lot does not scroll round, so is always visible to bidders. The LEAN operators have no incentive to sell the system to foreign users because Lysis have the rights to sell the LEAN software overseas. However, Lysis have not actively sought to market it and have not been approached by potential overseas users. (JB)

Buyers were drawn onto the LEAN auction by operators telephoning them with details of stock being sold. In early sales buyers would bid over the telephone to the auctioneer, but eventually they all took the software to bid electronically. LEAN's growth was inhibited by the smaller volumes it was trading relative to the other systems: *"It is a chicken and egg situation, when you have numbers farmers think you are taking off and put stock on and when you have numbers abattoirs dial in"*. J. Thomson recognised that LEAN benefited from the investment by EASE in connecting with buyers and making farmers aware of electronic auctioning: *"EASE did all the good work. EASE told everybody what an electronic auction was. All LEAN had to do was say, we have an electronic auction"*. LEAN operators found that some abattoirs would not use electronic auctions and when abattoirs bought on description and found the description incorrect they would try to push the price down. The buyers buying direct off farms also had an incentive to tell their managers that purchasing stock electronically was a waste of time. Even ANM's subsidiary, Scottish Premier, did not buy livestock on electronic auctions (JT). According to Thomson there was almost no co-operation between the competing systems, but at the fieldsmen level they did meet informally and discussed the accuracy of classification at particular abattoirs (JT).

The LEAN auction network contracted as initial operators withdrew from electronic selling. By 1995 Northwest LEAN and Acklington in Northumberland withdrew leaving Thomson, Roddick and Laurie the

sole northern auction. Northwest LEAN were concerned that sheep sold in LEAN were coming out of their live markets. They sold their share of LEAN back to the consortium for a nominal value. In the south the LEAN operator in Stratford-on-Avon withdrew from auctioning and leased his market to someone who was not interested in selling electronically (JT).

In 1995 J Thomson believed that, relative to the other electronic auction systems, LEAN lacked “*street credibility*”. LEAN appeared to be the least successful of the five competing auction systems, measured in terms of the numbers of livestock sold, which made it difficult to attract sellers and buyers to the LEAN system. However, Thomson claimed that numbers of animals traded was not a reliable indication of the success of each system. While other auction systems had sought to maximise their throughput, LEAN had sought to find a level of operations which would cover their costs. According to J Thomson, the LEAN strategy was to “*stay in profit and stuff the growth*”. The dominant cost for LEAN operators was the paying of fieldsmen. Thomson claimed that LEAN had been left behind by the other systems because operators held back on promoting electronic selling, believing it would damage their live markets. As the third national electronic auction system LEAN members were those auctioneers who had been unwilling to take on an EASE franchise or to join BEACON, so it is unsurprising that to some extent they were relatively less committed to electronic selling and joined defensively, ensuring that if electronic selling took off they would not be left out. While the number of operators in the LEAN network shrank, the level of activity fell further because full-time fieldsmen were being replaced by fewer part-time fieldsmen: “*We all lost money initially*” (JT).

### ***Other Products***

Some LEAN operators considered trading grain electronically, but did not proceed. Thomson, Roddick and Laurie have used the LEAN system to sell timber, holding the first timber auction in October 1995. Thomson, Roddick and Laurie have an ongoing estate management business selling timber by traditional auction so the electronic auctioning of timber combined two areas of expertise. Selling timber required changes to the LEAN system, notably the method of description and the calculation of the value (n cubic metres at X per cubic metre) (JT).

### **APEX**

John Lind, the chief executive of ANM Group, who had been instrumental in the setting up of EASE, left ANM in August 1990 to pursue diverse interests in farming, meat processing and agricultural produce trading. In 1991 he was looking to find a role for M Sobey, who was the company accountant at ANM Group. He knew that Montrose Mart in Scotland was interested in developing electronic selling. On a visit

to Canada, J Wideman of OLEX told Lind of the alternative NEMI system. Lind bought a licence to use the NEMI system in the United Kingdom. The most significant difference between the two Canadian systems was that the NEMI system could be run on an IBM compatible personal computer rather than a mainframe, thereby reducing the cost of setting up the system. (JL)

Lind decided to operate the system but franchise the sourcing of stock. According to Lind this was because of the costs of maintaining a force of fieldsmen. When they franchised the operating of the system in Scotland they kept an area around Aberdeen, partly to avoid upsetting EASE by competing on ANM's doorstep, but also as a potential franchise for themselves. Lind and Sobey followed the same strategy for franchising as EASE, but the aim was to have fewer franchisees covering larger areas to avoid the conflict between franchisees seen within the EASE network. Lind believed that EASE lost ground because it had too many franchisees. Lind's aim was to operate with lower costs than EASE, due to the lower purchase price of the software and the lower cost of the hardware.

On behalf of Lind, Sobey approached a number of auctioneers to see if they were interested in taking a franchise for the new system. Rugby Livestock Sales were considering becoming EASE franchisees in 1989. The EASE franchise for the Midlands had been taken by David Duffy, who was then a director of Rugby. Rugby watched EASE develop for two years. A. Harrison of Hawkins and Harrison, the operators of Rugby Market, claimed that they believed that a successful electronic auction should have national coverage and that the EASE franchisees each had too small a territory to make the system work successfully (AH). Harrison wanted a franchise for the whole of England, but it was agreed to sell a franchise for Wales and England south of the M62 motorway which links Liverpool to Hull (MS). It was Harrison who suggested the name APEX, short for Agricultural Product Exchange. Lind adopted this name as the name of the United Kingdom operation of the NEMI system, setting up APEX UK based in Aberdeenshire to operate the system, with himself, Mike Sobey and Ian Hay as directors. All three of them had been closely involved in ANM's setting up of EASE, with Ian Hay moving from the technical position at EASE to take up the role of technical director with APEX UK. Montrose Auction Company and Rugby took equity stakes in APEX UK, with Rugby setting up APEX Ltd. to sell livestock in England south of the M62 and Montrose trading as APEX Scotland to sell livestock from Scotland. APEX Ltd was a subsidiary of Hawkins and Harrison, the operators of the Rugby livestock market. Harrison of APEX Ltd argued that the structure of LEAN and BEACON had followed EASE, with local franchises, but that this structure was defensively attractive, reducing their commitment to develop electronic sales because sales would be displaced from their live markets (AH). APEX UK wanted to franchise through established auction companies because they had strong links to the farmers, but, according to Lind, they should ideally keep their live and dead-weight operations separate to avoid the temptation of leading farmers to sell the

stock through the live market. Both Rugby and Montrose operated their electronic and live markets using different staff, sourcing electronically from across a very wide electronic franchise area and locally for their live market. (JL). APEX also had two franchises in the Highlands and Islands, Caithness in Thurso and Argyll Auction Company in Oban who used the system for seasonal store stock sales, but these sales had stopped by 1997.

Each franchisee has a stake in APEX UK and two representatives on the board. APEX UK lost £652,000 in its first year due to high start-up costs (CS), but then made profits. As with EASE, the franchisees paid a minimum fee plus a percentage of turnover above a specified level. The minimum fee was set at a lower level than had been the case with EASE to attract franchisees. APEX's lower cost base allowed fewer franchisees paying lower amounts. Sobey recognised that APEX had been able to learn from EASE's experience in structuring their fees. When EASE was established the lack of knowledge about the costs which would be incurred by franchisees and the volumes of stock they would trade and made it difficult for EASE to decide on an efficient fee structure. (MS)

Unknown to APEX UK, in June 1992 Harrison took on Frank Yeo, the West of England EASE franchisee, to manage APEX Ltd in Rugby. Frank Yeo *"felt constrained by being bounded by the sea on two sides and the boundary with another franchise"* (FY). Yeo claimed that his existing buyers and sellers would follow him to APEX and that fewer but bigger electronic auctions with large franchise areas would meet the "urgent need" for a daily market price for specified qualities of slaughter stock and smooth out price variations. ANM found the coincidence that three of their ex-employees had set up a similar system and that one of the new system's franchisees had induced one of their own franchisees to break his contract difficult to accept and suspected that there had been a plan by Lind to entice Yeo into breaking his contract with EASE (JL). ANM unsuccessfully sued APEX UK and John Lind for an alleged breach of contract and also sued Frank Yeo for breach of his EASE franchise agreement.

In Rugby, Harrison's strategy was to achieve market dominance in English electronic livestock selling, whereas Lind and Sobey of APEX UK believed that a slower strategy of growth would be more realistic due to the competition existing in the market. Montrose followed a more conservative policy of building their electronic business slowly. To gain a dominant position in the market Rugby took on a large number of fieldsmen and cut commission costs and subsidised haulage to gain business (JL).

Initially APEX Ltd sourced stock from south of the M62. The gap in the coverage of the APEX system between the M62 and southern Scotland was filled in June 1995 when Colin Young, who had been operating the Yorkshire EASE franchise at Easingwold in Yorkshire, left EASE and took on the whole of North of England for APEX. Young had started as the manager of the electronic auction for Lawrie and

Symington in Lanark, one of the earliest operational EASE franchisees, and his success there had drawn other franchisees into EASE. He left Lawrie and Symington to set up his own EASE franchise in Yorkshire, Ease-in-Wold. Colin Young brought his existing EASE franchise customers with him and continued to operate the Northern APEX auctions as close emulations of the earlier EASE auctions, with the Northern APEX sale tending to operate without reserve prices, whereas the southern sale run by Frank Yeo did (AH).

The Ministry of Agriculture Fisheries and Food (MAFF) were encouraging producers to be certified under the national farm assurance schemes, which set standards for husbandry, welfare and traceability. Smith, a market consultant with the MLC, undertook a study funded by MAFF to assess the impact of farm assurance on the use of the APEX electronic auction system. This concluded that because of the requirements of the final meat retailers, farmers should be encouraged to gain farm assurance under FABL, the largest scheme in England. Safeway and Sainsbury had said that they did not want to sell meat which had been through live markets, but at that stage their supplier abattoirs were still using live-markets because they could not source all the required stock directly from farms. It was proposed that APEX appoint a group procurement manager to encourage farmers to gain farm assurance, thereby becoming more pro-active in their links to farmers. APEX had looked at using staff from the Scottish Agricultural College to advise their supplying farmers (CS).

APEX Ltd employed fieldsmen to procure stock for the system, with the core of the fieldsmen being fieldsmen who were recruited by Yeo, including many with experience of working as fieldsmen for EASE, with the remainder mainly coming from an abattoir background, with some farmers and auctioneers. According to Harrison of APEX Ltd, abattoir trained fieldsmen were the best because they understood dead weight marketing and dead weight grading (AH). The marketing of the system was carried out by holding producer evenings at which the system was demonstrated to farmers. APEX Ltd also produced a news-sheet, with a plan to produce three per year, but by 1995 its production had been discontinued. In addition to these marketing activities, fieldsmen could log into auctions using their lap-top computers to demonstrate the system to farmers thinking of selling electronically (AH). A weekly summary of prices was produced called *Stocklines* for distribution to producers. When sales were made APEX Ltd telephoned the fieldsmen who then contacted the producer, this "*keeps close contact between producer and fieldsmen*" (AH). Approximately one third of fieldsmen connected to the system themselves to watch the sales (AH). By 1995 most APEX fieldsmen were commission rather than salary based, operating without fixed boundaries for procuring stock (AH). According to Lind, APEX Ltd put large numbers of fieldsmen out on the road provided with cars and telephones. Lind found that many of these fieldsmen were generating insufficient sales to cover their own costs (JL).

The APEX system runs on a personal computer located in a cottage on one of John Lind's Scottish farms at Balgove, near Old Meldrum, Aberdeenshire. The computer is a Dell450SE2 personal computer with a 400M6 hard drive, split into two mirrors to give back-up if one fails. It connects using an X25 communication board connecting to GNS using a private circuit 48k kilostream data line. Buyers connect using the BT GNS data network to download the catalogue and bid during auctions. The auction controller at the franchisee used specialised work station software but connected in the same way. At the end of the auction the system produces two reports for transferring to the franchise terminal: an end of sale report and individual buyer reports (IH). According to Mike Sobey, the EASE system cost ANM less than £250,000, with the NEMI licence costing APEX substantially less than ANM paid for EASE. In the APEX accounts dated 31<sup>st</sup> May 1993 the APEX software and hardware are valued at costs as £27,383 and £14,151, giving a total cost of £41,534. Frank Yeo claimed that APEX was a more advanced system than EASE, but that this did not affect the sale itself (FY). APEX Ltd adapted the APEX UK system to integrate their own accounts package and to record flock and herd histories (AH). APEX UK have tailored the software to operate as two types of Dutch auction: one "sudden death" and the other a "multiple winner" in which when the clock stops other bidders have time to buy at that price. The multiple winner auction was developed for the Northern Ireland milk auction: *"At the time we thought it was a daft idea, but we had to eat our words"* (AH). The APEX system does not require the purchasers to use specialised software: they can either use a dumb terminal or Windows terminal emulation, connecting to APEX using a modem and telephone lines. Ian Hay claimed that not requiring system specific software running on the bidder's computer was strength of the APEX system, giving the operator the ability to add new products without requiring software changes for bidders. APEX UK have added a front-end database to allow franchisees to create text catalogues for downloading on their PCs. They use BT Dataplus to transfer the files to the central machine (IH).

APEX started operating in June 1992, selling prime cattle, sheep and cull cows. APEX held cattle sales on Wednesday and Friday and sheep sales on Monday and Thursday. APEX Ltd in 1995 charged 2.75% commission on cattle sales, as against 2.5% in the Rugby live market (AH). Unlike BEACON, APEX followed EASE and LEAN in setting a grid of premiums and deductions to compensate for variations from par carcass grades. This is hardly surprising considering the extent to which the personnel involved had at various levels been involved in EASE, from Lind, Sobey and Hay at APEX UK, through to the network of assessors and producers who had come to APEX through the defection of Yeo and Young. Antony Harrison argued that electronic sales on APEX mostly displaced direct dead-weight sales: *"It is a smaller step for the farmer to take to go from dead weight to electronic than it is from live auction to electronic."* On the APEX system producers did not have to set a reserve price, but producers who were new to selling

on APEX tended to set a reserve: “They tend to set the reserve a bit high, what they would prefer rather than the rock bottom price they are willing to accept”(AH). As producer’s experience grew, they increasingly allowed APEX to set the reserve. (AH)

In 1995 over thirty abattoirs were regularly using the APEX system. According to Harrison, the largest abattoirs tended not to use the electronic system as they had teams of buyers buying direct or at live auctions. Harrison believed that large abattoirs regarded electronic auctions as a threat to their market strength and the competitive advantage they enjoyed through having nation-wide procurement networks. Harrison claimed that supermarkets wanted to bypass the live auction, with one seeking to have all their meat sourced by abattoirs direct from farms by 1<sup>st</sup> January 1996 (AH). Many abattoirs often used the APEX system for topping up when short of stock, while others bought regularly off the system. Harrison’s experience supported Christie et al.’s study of EASE which implied abattoirs would use the electronic systems for meeting shortages in their core procurement strategies.

APEX UK had looked at the electronic selling of timber and fish and had run a fodder auction. They had looked at selling grain but had not been able to sell any due to “*buyer resistance*”. John Lind claimed that grain buyers were frightened that a widely reported higher price on the electronic system would force up the price of all their purchases of grain direct from producers, but that as the cost of maintaining a large direct buying force becomes uneconomic and the numbers of buyers falls the attraction of electronic grain selling will increase (JL). APEX Ltd tried selling pigs, but after nine months they withdrew. In 1995 APEX Ltd was selling eggs electronically for a wholesale egg merchant, and APEX UK was selling milk for the Northern Ireland Milk Co-operative. The Northern Ireland Milk Cooperative contacted APEX and APEX modified their system to allow the Dutch auctioning of milk. Their first milk sale sold 169 M litres, worth £55M in three hours (AH). APEX had discussed providing a similar system to Scottish Milk but, according to Harrison, Scottish Milk decided to buy a Schelfhout system from Belgium because APEX did not have software to handle the accounts (AH). In 1996 APEX were discussing electronic milk auctions in England and an electronic wool auction with the Wool Board (AH).

APEX UK were involved in providing support to the setting up of the AGMEX system in South Africa. South Africans surveyed electronic auctions throughout the world and they visited the United Kingdom, saw the APEX system and APEX passed them on to NEMI in Canada. According to Hay, APEX UK gave the setting up of the NEMI system in South Africa “*a good push*”, but contractually the links are back to NEMI in Canada. Following the success of selling the NEMI system to South Africa, APEX International was formed to market NEMI in other overseas markets. APEX International was one third owned by NEMI, one third by APEX UK and one third by APEX Ltd. Ian Hay claimed that NEMI has the software

and APEX United Kingdom the expertise. J. Wideman, Harrison and Lind went to Argentina in 1994. The concept of electronic auctions was attractive to the Argentine government because Argentina has a herd of 59M cattle, six times the size of the United Kingdom. The Argentineans first contacted APEX, but NEMI owned the software. It was planned to set up a subsidiary in Argentina to run the system. The Argentina contacts came through Argentinean government representatives via the MLC. AH describes the relationship with the MLC as “very constructive”. (AH) It was planned that the sale of APEX to the Argentine would be announced at the 1995 Royal Show (CS). APEX UK were also approached by organisations interested in setting up electronic auction systems in Sweden, France and Belgium, but these were not taken beyond initial meetings. (JL)

### *Operation of NEMI/APEX System in South Africa*

In 1987 Ian Dickson of Vleissentraal became aware of electronic marketing when he read a journal article written by Wayne Purcell of Virginia. He wrote to Virginia who wrote back telling him about the existence of CALM in Australia. From an advertisement in an agricultural magazine he contacted EASE in Scotland, who suggested he contact Wideman in Ontario. Dickson carried out a comparative assessment between the CALM system and the NEMI/APEX system. The reasons for choosing NEMI were that at that time sanctions made the acquisition of the UNIX based computer hardware required for CALM very difficult, whereas NEMI only required a 486 PC. The NEMI system was also seen as being more user friendly, requiring a lower level of technical skills by the system operator (ID).

AGMEX is wholly owned by Vleissentraal, a large co-operative. The system uses the South African public X25 Easyaccess service. AGMEX started operating in 1995 selling feeder cattle to feedlots, corn and carcass meat. The system for describing feeder cattle was developed co-operatively with representatives of farmers and feedlots. Vleissentraal trained their assessors using two day seminars led by a consultant with experience of the abattoir industry. Assessors had to take an examination and had to assess feedlot cattle before passing the assessment. (JW) The sale of feeder cattle in Republic of South Africa is highly seasonal, being restricted to June, July and August (ID). The electronic sales of feeder cattle on AGMEX were less successful than expected. According to Dickson this was due to existing livestock auctioneers setting up local saleyards in partnership with district farmers’ associations in which the district farmers associations receive a share of the commission which is used to fund community projects. The use of the electronic auction would remove this source of funds for farmer associations. Also, as elsewhere there was resistance from feedlots who did not want a transparent competitive market which would drive up prices.

The South African corn (maize) market is highly volatile due to large variations in production. Until 1996 South Africa did not have an open grain market, instead prices were set annually by the government. *"The local grain market was recently 'liberalised' and, to put it mildly, it is at present (June 1997) in chaos with all the role players jockeying for the best position"* (I. Dickson) In 1995 the national harvest was 4.41 million tons due to drought, but was 9.72 million tons in 1996. South African domestic consumption is approximately 7.2 million tons. AGMEX started electronic grain sales in late 1995, offering 130,729 tons and selling 110,542 tons. At that time stocks were short and prices were rising. Electronic grain selling was more difficult in 1996 because there was a surplus of grain available, which led to sellers being unable to obtain the prices on AGMEX that they sought. Of the 458,709 tons offered only 19.2% was sold. Ian Dickson was pessimistic about the future of electronic selling shortly before the start of the 1997 grain season. World grain prices had dropped and a large crop was forecast in the United States. Sellers were looking for 660 Rands per ton while buyers sought the world price of 510 per ton. AGMEX hold weekly grain sales.

In September 1996 AGMEX commissioned a survey of 25 grain buyers. At that time the grain sales were having problems with producers withdrawing lots from sale. The perceptions of buyers to the system were generally negative because the auction master was seen to be capricious, sometimes accepting a bid and other times withdrawing the lot. This was because producer co-operatives were setting their reserve prices too high. Sellers were disconcerted that some lots did not sell at prices higher than a preceding lot had sold. According to two of the respondents the co-operatives were willing to accept telephone bids after the sale far lower than the highest bid on the system which they did not accept. Other bidders were suspicious that there was "bogus" bidding on the system to increase prices. Only twelve of the buyers surveyed had used the system to buy grain, but all twenty five logged in to monitor the prices achieved in the electronic sales.

Carcass meat sales started on AGMEX in 1997. A sale is held each morning. In their first 19 sales 5,830 carcasses were offered and 56% were sold electronically. AGMEX plans to start trading used cars. Dickson sees the system expanding: *"but it will be a long and difficult road."* *Buyers have been reluctant to register a bid on the system, preferring an opaque market to a transparent market, particularly for carcasses and grain. "If the buyer controls price discovery and price communication, he controls the farmer"* (ID).

AGMEX commissions are 2% to 2.5%, of which AGMEX only receives 0.5%. AGMEX initially appointed three grain agents and held meetings with buyers across the country to introduce the system.

AGMEX covers the whole of South Africa and Namibia, and also has grain buyers in Zimbabwe, Botswana and Swaziland. (ID)

## DIRECT

The final United Kingdom electronic auction system was developed by County Auctions. County Auctions operate a local live market at Wooler in Northumberland. George Forbes the Managing Director of County Auctions first became aware of electronic auctions when he was approached by James Stephenson of York in 1989 who was considering taking on an EASE franchise (GF). Stephenson's and Carlisle Market were negotiating with ANM for a North of England EASE franchise. York and Carlisle did not feel that they would be able to cover Northumberland, so sought to include County in their consortium. After the breakdown of negotiations between Stephenson's and ANM, which led to the formation of BEACON, County then took the EASE franchise from the Scottish Border to a line linking Whitby to Carlisle, becoming, after ANM, the second franchise to run a cattle sale.

County found the concept of electronic auction selling attractive because for fifteen years they had operated a dead-weight marketing division, which sourced stock from farms and negotiated to sell it dead-weight to meat companies. This area of their trade had grown because farmers did not want to come to live auctions and the large meat companies were increasingly buying direct from farms. By offering to find dead-weight buyers for farmers County were protecting their market share. Forbes saw that electronic auctioning could have benefits for both farmers and buyers, believing that the welfare benefits have helped the growth of electronic auctions, as buyers have become more welfare conscious, and that because supermarkets suspect auctions push the price up, they want stock direct from the farm. Also Forbes believed that the farmers liked the auction *"as it protects them from buyers putting their heads together."* The electronic auction *"has not got the social advantages of the auction market, but ... their time would be better spent than taking a few cattle to market."* County concentrated on developing the electronic auction of sheep using EASE, making up the grid and canvassing the wholesalers and abattoirs. County started off using EASE with very few buyers for sheep and cattle: *"It was virtually a question of taking a reserve price"*(GF).

County's location at Wooler was within miles of the northern boundary of their EASE franchise area and they had traditionally sourced a large number of cattle for their live and dead-weight business from the Scottish Borders. However the EASE franchise for Southern Scotland was taken by Lawrie & Symington of Lanark, giving Lawrie & Symington exclusive rights to source stock from the Borders. To source cattle or sheep from across the border for sale on EASE, County had to pay Lawrie & Symington a fee to

compensate them. County rapidly expanded their use of the EASE electronic auction and Forbes considered that they were the most successful EASE franchise. However, Forbes felt the franchise fee paid to ANM and the fees paid to Lawrie & Symington to source stock in Scotland made operating their own electronic auction attractive. Forbes also believed that ANM's ownership of Premier Meats, one of the largest meat processors, was seen by both farmers and other processors as undermining the system's independence: "*these people don't want to help ANM*". He saw that an independent system would overcome this suspicion (GF). County approached Xavier, a company who had supplied administration systems to major livestock markets, including Gloucester, York, Perth, Stirling and Carlisle, and worked with them to develop an electronic auction system for County. County gave EASE the required six months notice of terminating their contract in March 1994. The new system, DIRECT, was owned outright by County and used the personal computer hardware and network connections bought to support EASE. The DIRECT system started operation in August 1994. DIRECT charged the seller 2.5% commission, compared to the norm of 3% at Scottish live auctions (GF).

The DIRECT system screen improved on the layout of the EASE system screen. Whereas the EASE screen scrolled with the description of the lot for sale quickly disappearing off the top of the screen, on the DIRECT screen the description of the lot is permanently shown in the top half of the screen. The system could operate with buyers connecting using dumb terminals, but ideally buyers used personal computers running DIRECT bidding software. When EASE was being established buyers were wary of spending £2000 on a computer, but when DIRECT was being developed the cost of personal computers had fallen and the majority of buyers connecting to EASE were using computers running terminal emulation software. The DIRECT system operates on a Motorola 8420 33Mhz personal computer based in County's offices in Wooler connecting to BT's data network using a 14.4 kbs connection. County have an agreement with Xavier, the system's developers, that they will not sell a similar system to anyone else in the United Kingdom. The system software cost approximately £100,000 to develop. The DIRECT system is supported through a maintenance contract with Xavier. (GF)

One change which DIRECT made over the EASE system was to dispense with the use of the grid of premiums and deductions to compensate for variations in grading of cattle. Forbes was confident that live assessment could be reliable enough to allow bidders to buy on a flat-rate basis, giving the farmer confidence that the cheque he received two weeks later would not show deductions due to grading. Forbes argued that electronic selling requires qualified people to do the grading and that "Direct's success depends upon the skill of its fieldsmen"(County Auctions, 1994). Forbes claimed that Direct's strength was in the accuracy of their stock descriptions. Other auctioneers have "*run it almost defensively to stop anyone else getting into their area* " and use junior people to assess the stock (GF). Smith of the MLC

believed that DIRECT was paying its fieldspersons more than other electronic market operators, in the region of £25,000 to £30,000 per year, to retain the most qualified people. Smith estimated that taking into account other costs each fieldsmen would have been costing over £45,000 per year. These rates were “to get the best” but three of their fieldstaff left in June 1995 to set up Borders Livestock Exchange. County encouraged producers to become Farm Assured, as it increased the amount supermarkets and exporters were willing to pay. Unfortunately, each supermarket had been introducing their own farm assurance scheme - Tesco, Sainsbury and ASDA. Forbes claimed there were few differences between the schemes (GF). Forbes was concerned that the lack of success of other electronic auction systems was damaging the credibility of electronic auctioning: *“What we have needed is for the other systems to get more successful - its a big worry to me that the other systems are not as successful as I feel they should be.”* BEACON was seen by Forbes as Direct’s main competitor due to its network including some large, well established auction companies (GF).

DIRECT had investigated selling grain and in 1995 Forbes said that he would be starting grain sales “soon”. Grain selling had been held up by “getting the staff in place.” County had held a trial grain sale, but this was not successful. Two buyers would not connect electronically because, according to Forbes, they did not want their local merchant to know they were buying grain through DIRECT, so they bid by telephone. On the one hand, Forbes claimed, grain is easier to describe than livestock, but there is no tradition of auctioneers selling grain and some major buyers saw auctions as a way of increasing the price. Forbes found large grain buyers tied to particular grain merchants who were tied to known farmers. According to Forbes, grain is traded on low commissions of 50p to £1 per ton. In developing the grain market Forbes aim was to get large co-operative producers to commit to sell electronically, but the barrier was found to be persuading buyers to use the system (GF). In 1997 Forbes believed that the lower prices of grain would make the setting up of a grain auction more feasible.

## CLASS

By 1994 there were five similar computer livestock markets in the United Kingdom in competition. In selling livestock competitively to remote buyers they were also competing with a satellite video auction system. CLASS (Central Livestock Satellite System) was the first satellite video livestock auction in the United Kingdom. CLASS was founded and owned by David Jones of Newton Abbott, Devon. Jones already owned Newline Systems, which in 1995 was the largest supplier of information technology systems to the auction market operators and the operator of a service for monitoring the credit worthiness of auction’s customers. Jones noticed that smaller markets were closing because they were losing money and that the proportion of stock passing through live auctions was falling as the grocery chains pressed

their meat suppliers to buy directly. In response to this long-term decline in live markets Jones started planning in 1991 a video cattle auction. It was decided that the use of telephone lines would not give good enough picture quality, so the use of satellite video was seen as a technically acceptable alternative to run a cattle market emulating a traditional live market. Jones claims that at this point he was unaware of the existence of satellite feeder cattle auctions in the United States . When he learnt of the Superior video cattle auction in the United States he visited their headquarters in Fort Worth, Texas. Prior to seeing the Superior video auction in use Jones was going to use a push-button auction with the lot and the current asking price displayed on the television screen. Jones had at this stage heard descriptions of the EASE electronic auction but had not seen it in use.

The two most significant differences between the United States systems and the system that Jones was planning for the United Kingdom were that the United States system was wholly for feeder cattle while the United Kingdom system would be for slaughter stock, and the volumes traded by satellite in the United States were far higher than could conceivably be traded in the United Kingdom. In 1994 Superior sold over 1 million head of cattle, which is equivalent to the whole United Kingdom annual cattle production. In the Superior auction agents who had procured the stock spoke to bidders during the auction by telephone. Bidders watched the auction on satellite television, seeing a video of the stock on offer, and could hear the auctioneer, with an image of the auctioneer appearing occasionally. Jones believed the pace of selling to be slow, with lots taking up to 10 minutes to sell with the auctioneer “singing away.”

Jones decided that the structure of the Superior auction was not suited to the United Kingdom because, instead of lots of 1500 cattle, they would need to sell smaller lots, but Jones liked the use of a bid relay because it “*gave dynamism.*” Initially CLASS used Plymouth University’s television studio, for which they were charged £500 per hour. This would have represented an annual cost of £100,000, so CLASS set up its own studio in Newline’s offices in Newton Abbot. The contact with Plymouth University came about because Jones read an article describing a link-up between Plymouth University and Canada during the Devon Show. Jones contacted Plymouth University to find out how it was done and found out that they had a satellite uplink funded by the European Space Agency, who also paid for their space segment. Instead of agent relays CLASS used two rows of students from Plymouth Seale-Hayne Agricultural College. Bidders could see on their television screens the cattle, the auctioneer and the two rows of bid relays. A lot took on average a minute to sell, with an average of 8 cattle in each lot. Newline developed the software for the administration of the auction and the links to abattoirs. The administration of the auction was centralised at Newton Abbot (DJ).

Jones visited abattoirs to explain the concept of satellite auctioning to buyers and how it would save them the costs of visiting live markets. CLASS paid for 25 “vital users” to be connected to the satellite broadcasts, which cost £350 each. To source stock for the system Jones contacted auctioneers. Participation was sold to auctioneers on the basis that CLASS would allow them to offer direct delivery dead-weight selling in addition to their existing live weight auctions. Satellite selling would therefore enable auctioneers to recapture business lost to direct dead-weight selling. Eleven auctioneers covering the United Kingdom joined CLASS, plus one in the Irish Republic. With hindsight Jones recognised that many of these markets were struggling financially and joined CLASS as “*a straw to the drowning man.*” The auctioneers employed fieldsmen who went out and videoed the stock and posted the tapes to Newton Abbot using the public post. The fieldsmen predicted the EURO classification of the stock, but this was only as a guide to bidders. Bidders were expected to assess the stock from the video. The fieldsmen also estimated the weight, the accuracy of which varied between fieldsmen (DJ). Initially cattle could be sold pence per kilogram liveweight or dead-weight, but it rapidly became almost wholly dead-weight. The break-even point for CLASS was calculated as being a throughput of 1200 head per week. The first CLASS sale was in November 1992 when 300 cattle were sold in 55 lots to 40 buyers. (Farmers Weekly, 6/11/92, p24). CLASS’s annual costs included £50,000 for a satellite uplink and £60,000 for the space segment. Centralising invoicing ensured that buyers and sellers using CLASS knew they were trading using CLASS, unlike in EASE, LEAN or BEACON, where they might associate with the franchise holder (DJ). The 600 cattle per week being sold by CLASS, at £700 each, would have been a turnover of £420,000 per week or approximately £20M per year (CS).

**Users' Perspectives**

By 1994 there were five competing electronic auctioning systems in the United Kingdom plus the CLASS satellite video auction system. Each of the electronic auction systems traced its history back to the OLEX system in Canada.

	EASE	APEX	BEACON	DIRECT	LEAN
First Operation	Nov. 1989	June 1992	July 1992	August 1994	April 1992
Participants	Thainstone Perth Lanark Easingwold Hereford Chippenham Guildford	Rugby Montrose	Carlisle Gisburn York Chirk in Clywd Newark Banbury Norwich Ashford Neath Yeovil	Wooler	Wiltshire Stratford Derbyshire Acklington Dumfries Cumbria
Developers of Software	OLEX	NEMI	ASC	Xavier	Lysis
Hardware	DEC VAX	486 PC	Sequent UNIX	486 PC	Motorola UNIX
Communications	BT Dialplus	BT Dialplus	BT Dialplus	BT Dialplus	BT Dialplus
Commission (cattle)	1 - 2.5%	2.25%	1.25 - 2.5%	2.5%	2% cattle

According to Wideman, the developer of the two Canadian systems, the existence of five competing systems was due to the lack of trust within the United Kingdom industry: *“I am surprised at the number of competing systems which have developed in the United Kingdom. I have spent a lot of time in the United Kingdom; I suppose I was there a dozen times. As I met with some of the principals of the other companies it became less of a surprise to me. I discovered that they were very independent and that if they were not the first off the blocks, then they were not going to join the one who was. They wanted to do their own thing. The buyers love it. You are going to have much wider market fluctuations”* (JW). Wideman’s experience of the United Kingdom sector came through licensing of OLEX to ANM Group, licensing of

NEMI to APEX and his partnership with APEX in APEX International. Lind of APEX UK recognised that all the following systems had benefited from both the successes and failures of EASE and the awareness that it created amongst farmers and abattoirs (JL). Gillanders, the EASE general manager, was surprised by the resilience of other systems: "We have been amazed at how long some systems have survived". He argued that it was only the resources of a large group which allowed ANM to carry the costs of setting up EASE. "*We did expect it to expand more than it has, we would certainly be honest about that*". (EG) "*I would say BEACON will survive because it is backed by some very powerful auctioneers.*" (IS). "*BEACON is a very nice system, it is very well written and it works very well, ... but it is not integrated enough to become a real commercial threat to anyone.*" (IS).

For some buyers the electronic auctions had become a significant source of livestock. In December 1993 British Beef were reported as sourcing 75% of the 8000 to 13000 lambs bought by them each week electronically. This was reported as being in response to supermarkets wanting direct farm sourcing, although this could equally be achieved by direct farm buying if they knew where the stock were. Phill Hammam, general manager of British Beef, noted that fieldsmen "*must be accurate for the system to work*" (Farmers Weekly, 1993). Similarly, in the lamb industry, where there are a number of large lamb processors in the South of England who have to source stock from the North of England and Scotland, the use of electronic buying became a major part of their buying. However, for the majority of meat processors electronic auctions provided a useful but minor source of livestock. Murray Harvey, Scotbeef's livestock procurement manager, used EASE on its first cattle auction after they were approached by their local auction, United Auctions of Perth, at that time an EASE franchisee. Scotbeef were attracted to electronic auctions because of customer pressure to procure stock direct from the farm. At that time in 1990 70% of stock was being bought through live markets and 30% direct, but by 1996 this had switched to 70% direct and 30% through markets. The costs for Scotbeef to connect to EASE were low because they could use an existing computer to which they fixed a modem. To connect to CLASS Scotbeef had to buy a television and satellite dish, but "*it wasn't too bad because we got satellite TV and everybody sat here at night watching the late night movies*" (MH). On Scotbeef's weekly kill of 800 cattle, generally only 50 or 60 were bought electronically. Scotbeef buy cattle in all Scotland's live markets (MH). "*The concept is very good, it met the requirements from the supermarkets*" (M Harvey). However, the drawback to using electronic auctions was being able to buy the right stock in the right place. Scotbeef employ their own staff to source stock direct from farms as well as using electronic auctions. Generally farmers who know Scotbeef's requirements contact Scotbeef rather than Scotbeef staff canvassing for stock. The advantage of electronic buying was in allowing Harvey to plan the uplift of livestock and its delivery to the abattoir to correspond with times when there was a shortage of stock sourced by other means. Scotbeef organise their

own transport, using six wheeler trailers to collect cattle in loads of up-to seventeen head. To meet the needs of buyers who wanted to buy in lots which minimised transport costs Harvey had seen farmers increasingly group cattle into full and half loads (MH).

To assess the value of stock the buyer needs to know whether cattle are steers, young bulls or heifers, for sheep their breed, and the weights and the spread of weights: *"The tighter the specification, the more attractive they look to me."* Knowing the identity of the assessor and the assessor being independent are both very important to Harvey. Harvey claimed that assessors had become more reliable. Also Harvey claimed that knowing the identity of the farm was important: *"You know the men to buy from and the men not to buy from."* Scotbeef have bought using EASE, APEX, LEAN, each of which use a grid to compensate for mis-grading, and CLASS. They have used DIRECT, but tended to avoid flat-rate buying because Harvey distrusted the independence of the fieldsmen: *"if trade is bad you may not get quite what you bargained for."* (MH) A complication for buyers is that the grading and payment terms varied between the systems. *"Their grading and paying terms aren't quite the same, not their credit terms or whatever terms you actually see them on but the grades within each system do vary a bit and when you are bidding a bid for a R grade beast and you would expect to pay perhaps 4 pence more for a U grade, there are some systems where a U plus would be another 8p but there is not 4p difference between a U and a U plus, so you tend to keep away from those ones as you wouldn't want to be buying too many good cattle on that system. I think some of the penalties are not hard enough. I think especially if you happen to be paying a good price for a wagon of cattle and you happen to get a bad one in among them. Again with the sheep you can be paying a good price for an R grade sheep and if you happen to get an O, if you get 5 Hs the fat penalties on sheep aren't big enough so you have to be very wary what you are doing there. Especially if you get a lot of them, if you get one or two it is bad and bad enough, if you happen to get a lot of sheep badly drawn it is a disaster because you have no come back. You have to vote by your feet the next week"*(MH).

Harvey distrusted not knowing who else was bidding, suspecting that the auction operators were bidding up to the reserve (MH). He also argued that the multiplicity of systems led to fieldsmen competing with each other (MH). *"Their way of canvassing is 'I will get you so much for your cattle'. In the south west of Scotland, I have went down there and went up a farm road at 9.00 and 10.00 a.m. in the morning and I have been the 3<sup>rd</sup> or 4<sup>th</sup> man up the road. I only went down one day, I have never went back down because my business is going to buy cattle and stock - I go in and I bid the man a price and I get them or I don't get them. The systems are working, I think, against each other - where everybody is going up and everybody is bidding against each other. Unfortunately, the auctioneer doesn't get any money until he sells the stock. It is very very tempting for him to take the stock when they are not just quite ready. I*

would go in to see the stock or I would hope my men would go in and see the stock and if they weren't ready advise the man to keep them for a fortnight. So we would maybe miss out on the cattle that week but the electronic fieldsmen would go in or do go in and if they don't take them the next man will, because the different systems are competing against each other and the fact that if they don't get the 20 cattle that is £400 they are not going to get against the other man. So that actual trading is dangerous."(MH).

Harvey claimed that a buyer would expect to be paying less on an electronic system than buying direct because "if you were going to pay over you would offer the extra to one of your regular direct suppliers". He therefore believed that any rational farmer with high quality stock would tend to develop relationships with abattoirs who would be willing to pay a premium rather than offer his stock electronically (MH).

Harvey had found the CLASS video auction system useful: "I quite liked the Class system. You could see what you were buying. It is useful to see what you are buying without a doubt. It was really a guarantee, I suppose you could have taped the thing if you want. You bought the cattle that you saw and if the cattle didn't come in as what you bought you had a come back. You could see the conditions the cattle were kept in, you could see the farmer. You wouldn't say the people that were taking the videos were David Bailey by any means, they sometimes got it wrong, but once they got into the swing of it, yes it was quite good. It was quite good fun, you phoned up your studio in Plymouth and if you were lucky you got a nice young girl to chat to for half an hour on the phone and she did the bidding for you, yes it was quite good fun and the cattle, well we only bought them in Scotland and it was through the Cally Marts that did it and it was quite good. I can see those systems being great where your great big feed lots and you were seeing 50 and 100, 200 and 300 cattle at a time. The way farming is done here it is maybe just not so easy"(MH).

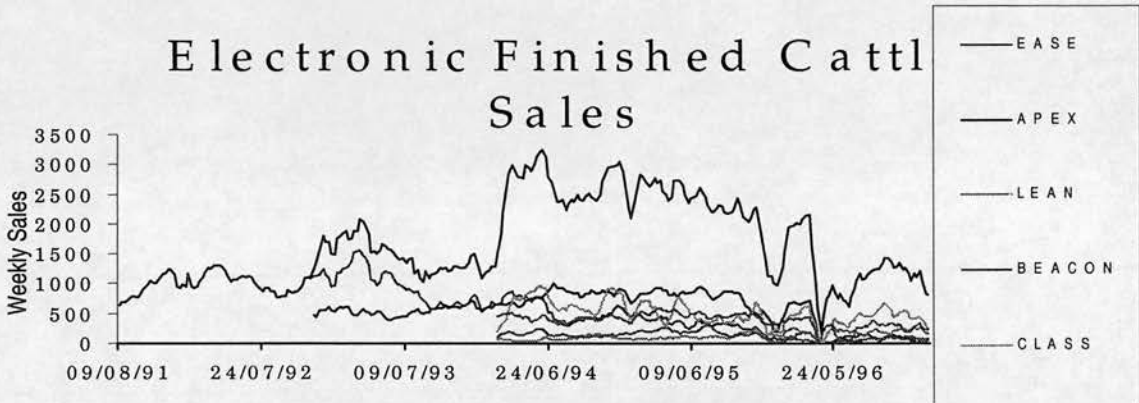
Scotbeef used United Auctions EASE auctions in Perth. Scotbeef did not use Aberdeen EASE or Agvision because "ANM are in direct competition with us in the meat trade." This decision was taken by Harvey when ANM moved to Inverurie and took over Premier meats. In 1995 Scotbeef used four electronic sales on the two systems then in use in Scotland: on Tuesday morning APEX, Wednesday morning LEAN, Friday morning the LEAN sheep auction in Perth and Friday morning APEX Montrose sheep. (MH)

The fieldsmen on the electronic systems could bypass the electronic systems by trading on their own account or privately brokering deals between farmers and abattoirs. Harvey of Scotbeef admitted that fieldsmen who ostensibly worked for an electronic network would telephone Scotbeef to discuss their needs then try to sell lots directly to him, by-passing the auction (MH). When working for commission some fieldsmen unsurprisingly had little commitment to the system they nominally represented, and the

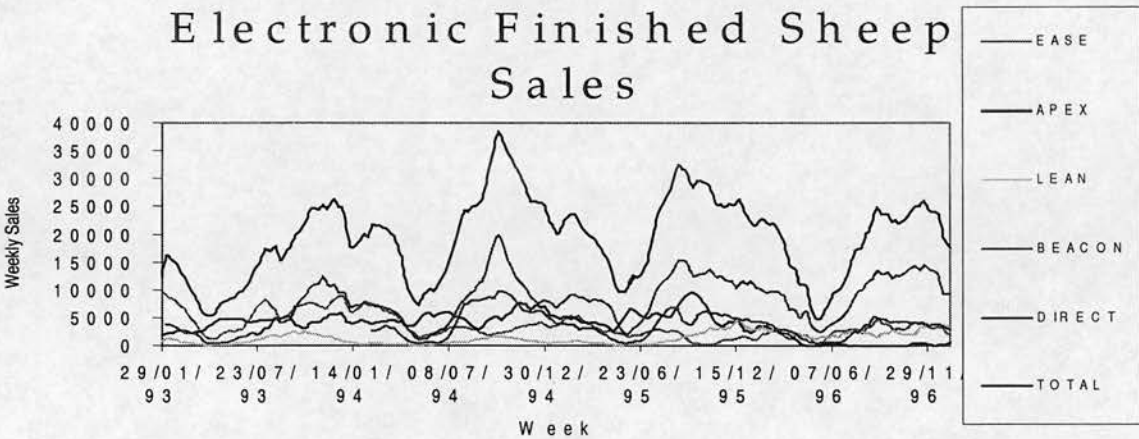
difficulty of monitoring them in the field made the policing of these abuses by the system operators nearly impossible.

**Relative Success of United Kingdom Livestock Systems**

**Table 7: Electronic Finished Cattle Sales**



**Table 8: Electronic Finished Sheep Sales**



The rolling four week average sales on the systems show that electronic livestock selling in the United Kingdom has been in decline since 1994. The seasonal pattern of electronic sheep sales matches the seasonal pattern of live lamb sales. The average weekly slaughtering of cattle in the United Kingdom is 71,000, but electronic cattle sales have never exceeded 3500. Average weekly lamb slaughterings in 1989 were 390,000, but total electronic lamb sales never exceeded 40,000.

In 1995 Antony Harrison of APEX believed that the electronic markets were taking 10-12% of the stock, *“with the balance split almost equally between live and dead-weight sales“*, while in June 1995 Farmers Weekly estimated the proportions as 6% for cattle and 15% for sheep (Wright, 1995). The relative success of electronic sales of lambs did not compensate for the failure to achieve the levels of cattle sales expected on each system. Although large numbers of sheep are sold electronically they are less profitable to sell than cattle. John Lind could not envisage a sheep only electronic system being viable. Taking into account the difficulties of handling, commission rates on sheep should be twice those on cattle but in practice in live and electronic auctions they are only slightly higher. The reason for this is a tradition in live markets of pricing sheep selling commissions low to gain farmers' cattle sales. Lind claimed that as a rule of thumb eight sheep equals one cattle, but live market commissions on cattle are £15 and only £1 per head on sheep (JL).

Chris Smith of the Meat and Livestock Commission suspected that the reported sales figures for the electronic systems reported in Farmer's Weekly were not accurate because they included lots sold manually by the auctioneers after the sale, claiming that on one week in 1995 APEX offered 120 cattle for sale but only sold 40 electronically. Smith argued that physical markets had survived in the face of direct buying because the auction markets had rarely failed to pay the farmers. In 1995 British Beef, the meat processing subsidiary of Vestey's collapsed owing several million pounds to farmers. When auction markets have been in financial difficulty they have tended to be bought by other auctioneers. Smith identified the high costs of transporting small lots as a weakness in electronic markets. Distant buyers are reluctant to bid for small lots as they may not be able to make up full transporter loads, which leads them to bid lower to discount the risk. Also, often it is difficult to access small farms with large articulated transporters. This was overcome by Frank Yeo when he was an EASE franchisee by arranging for farmers to deliver their stock to a local collection point. (CS)

In December 1993 Farmers Weekly (1993), in a special report on electronic livestock marketing, surveyed 1023 farmers. Only 21% of these farmers had used electronic auctions, with EASE and APEX the most widely used systems.

**Table 9: System used by farmers who had sold electronically**

EASE	36%
APEX	26%
BEACON	16%
CLASS	10%
LEAN	9%
DIRECT	5%

The main weakness in electronic selling for farmers was variation in carcass grading and the problems of arranging for the stock to be uplifted. The drawbacks cited by farmers were surveyed.

**Table 10: Drawbacks of Electronic Selling Cited By Farmers**

Differing grades	35%
Haulage problems	32%
Inability to study carcasses at distant abattoirs	22%
Unfair deductions	20%
Restriction on social life	19%
Unfavourable payment terms	17%
Restrictions on lot sizes	12%
Lower price	10%

**Table 11: Benefits of Electronic Selling Cited by Farmers**

No transport costs	67%
Convenience	60%
Animal welfare	50%
Better prices	49%
Access to national markets	44%
Improved feedback on classification	39%

While missing the social interaction of the live market was a disadvantage for only 19% of farmers who had used the systems, it was found to be the main barrier to electronic selling for non-users.

**Table 12: Reasons Given by Farmers for Not Using Electronic Auctions**

Restriction on social life/meeting other farmers	46%
Haulage problems and travelling time to distant abattoirs	43%
Do not understand how electronic auctions work	40%
Inability to study carcasses	38%
Restriction on lot size	30%
Differing grades from abattoirs	25%
Unfair deductions	22%
Unfavourable payment terms	17%
Lower prices	14%

That the greatest barrier to enrolling new farmers was the effect that it would have on their social life shows that attendance at markets was not determined by a calculation of expected prices and the opportunity cost of lost time, but included a large element of social significance. The emergence of electronic auctions was linked to the growing social isolation of farmers in an article in *Country Life* (Farndale, 1995). Of producers who did not use electronic auctions, 90% marketed through live auctions with 30% selling direct to the abattoir (Farmers Weekly, 1993), showing that the greatest resistance to electronic selling came from farmers who did not sell directly either. In the 1993 survey, despite the evidence that electronic sales were not growing, there was still optimism among abattoirs for the future of electronic markets, with 67% of respondents believing that the use of electronic auctioning would increase. While electronic selling had failed to achieve the expected levels, there were still pressures which people thought would increase the use of electronic livestock systems in the future. Harvey of Scotbeef argued that the EU proposed rules on animal welfare would increase the proportion of sales on electronic systems: *“Under these rules I would see us buying more stock directly” (MH)*.

### **Demise of CLASS**

Gillanders of ANM believed in 1995 that the United Kingdom livestock industry could not sustain five electronic auction systems plus the CLASS satellite auction system. CLASS, the United Kingdom satellite video auction system, ran into financial problems in 1995 because one of their agents, Wintertons of

Lichfield, went bankrupt with a bad debt of £200,000 (EG). Lichfield Market began to procure stock for CLASS, videoing them for sale but then selling them directly to abattoirs. Jones believed that this was insidious, leading Lichfield to conspire with other auctions to make CLASS bankrupt in order to take it over themselves: *“And that’s exactly what happened and we were not able to stop them. And the sad thing is from their point of view, because we were collecting all the money and distributing it when we had it, when the company (CLASS) decided to call it a day, we didn’t get caught, they did. I’ve never really understood how you can be that thick”* (DJ).

Jones sold the assets of CLASS on 15 March 1995 to Midland Marts of Banbury, retaining a share in it. The remnants of CLASS went into receivership in May 1995 with debts of £1.9M (CS). The principal creditors were auctioneers procuring stock for CLASS, some of whom lost over £250,000 (CS). Ian Smethurst of Midland Marts had not seen a satellite auction when Midland were actively considering buying CLASS. At that time CLASS was selling 500 cattle per week. Smethurst believed this could be increased to 1000 per week, including store and prime stock. Midland renamed the satellite auction SLAM (Satellite Livestock Auction Market) and from March 15 to 30 June 1995 operated SLAM. Midland soon realised that running a satellite auction was expensive and needed high volumes of stock and sound financial backing. Midland approached Stephenson of York, another member of the BEACON electronic auction network to take a share in SLAM, but they were not interested because, according to Smethurst, *“they were in it for purely protectionist reasons”*. Midland claimed they needed sales of 600 cattle per week to break-even (RP). Midland Marts were BEACON members, but in taking over CLASS they broke their agreement and were asked to leave, with the other BEACON members buying out their share of BEACON in November 1995 (RP).

ANM then approached Midland and proposed merging EASE with SLAM (EG). SLAM was not a name ANM liked, so the merged company was called Agvision. Jones became technical director of Agvision, but did not expect to be involved in Agvision in the longer-term. Jones felt Agvision was too ambitious, aiming for higher quality images through better quality video equipment and the addition of a farming news programme to the satellite transmissions: *“The overheads are horrendous, and I would never do it”* (DJ).

Agvision was a 50:50 joint venture between ANM and Midland, with Jones holding a small shareholding. ANM operate Agvision in Scotland and Midland Marts in England and Wales (IS). Smethurst argued that ANM’s strength was in being a financially sound operation with a strategy to develop beyond livestock auctions: *“I wish we were as wealthy as them”* (IS). The two advantages seen by ANM to satellite selling of store and breeding stock were that it would overcome the lack of reliable live animal assessment and

could reach the widely dispersed body of buyers are widely dispersed (EG). Historically a significant element of the store livestock market has been the sale of upland stock for finishing on distant lowland farms. Gillanders recognised that the losses suffered by farmers when CLASS went bankrupt had damaged farmers' confidence in electronic marketing, but argued that by being backed by England and Scotland's largest auction firms they will have confidence in Agvision (EG). The decision by Midland Marts and ANM to set up Agvision surprised many people because Midland were seen as being very uncommitted to electronic auctions and after the collapse of CLASS there was doubt whether anyone could make satellite sales profitable. For example, Lind the instigator of EASE and APEX saw no future in the United Kingdom for satellite auctioning due to the high cost of videoing stock (JL). In 1995 George Forbes of County Auctions expected that because of their ownership of Premier Meats, ANM Group would withdraw from active involvement in Agvision, and just keep their shareholding. Forbes believed that ANM and Midland were spending £500,000 on the launch of Agvision. (GF)

The EASE franchisees were not consulted and did not know of the creation of Agvision until it was announced publicly at the 1995 Royal Show. The collapse of CLASS undermined Jones' standing with auctioneers because a week before CLASS went into receivership he sold the satellite auction system to Midland and renamed the company. Auctions markets which used Jones' Newline Credit Assurance system were worried that through Jones' involvement with Midland in SLAM/Agvision, Midland would gain access to their credit information. United Auctions of Perth took out an interim interdict to try to prevent EASE linking up with Midland (CS). The merger happened when the EASE franchisees were two years into their second three year franchise period. They were given the choice of keeping their sole electronic auction rights but facing competing procurement for the satellite auction or re-negotiate to procure stock for the satellite system as well, but without sole rights in a geographic area (EG). Lawrie and Symington, Lanark, South East Marts in Guildford, Alder King, Wales & West and United Auctions all switched from EASE to LEAN. (EG) According to Smethurst EASE franchisees withdrew from Agvision because of "*proprietary, territorial attitudes.*" However, the withdrawal of the EASE franchisees helped Midland and ANM to launch Agvision unencumbered with an existing network: "*We all hoped and predicted that they would go because it left us to develop the system as we wanted*" (Ian Smethurst). UA switched from EASE to LEAN after the creation of Agvision: "*We were happy with EASE and we felt the nearest thing to that was LEAN.*" In 1995 UA were only selling between 70 and 100 cattle per week electronically. When operated with three staff David Leggatt estimated that their the break even level was 200 cattle per week. On sheep UA were selling 2000 per week electronically during the peak three months. UA's commitment is stronger to the live auction than the electronic auction: "*the avenue for prime sheep is through rings in Perth and Stirling, where UA handle 6-7000 per week.*" The change from EASE

to LEAN was not a big change for UA because LEAN used virtually the same grid as EASE with virtually the same compensations (DL). For operators the systems were very similar, except that when lots were not sold on LEAN, they were not re-offered on the system but sold over the telephone. Ex-EASE franchisees, used to the re-offering of lots, sought this facility as an enhancement. Also, they wanted the facility they had in the EASE auctions of being able to send messages over the network to individual buyers (JT). J. Thomson wanted to take the opportunity of merging the two systems to move away from selling on the grid system (JT). To make a change to LEAN requires a consensus amongst operators, in which case the cost is shared amongst LEAN members (JT). The new entrants to LEAN in 1995 wanted to keep their existing timeslots they had used with EASE as this would cause the minimum disruption for their regular customers. Thomson, Roddick and Laurie wanted UA and Perth to join with them in creating a single sequential Scottish auction (JT).

In Midlands' take-over of CLASS they adopted a clear separation between live auctioneers and people procuring for the satellite or electronic system. All of Agvision's fieldstaff have experience of one of the electronic auction systems. Some of APEX's fieldstaff transferred to Agvision with Frank Yeo. The aim in Agvision was to trade on Midland Mart and ANM's reputations as two of the largest auction firms and use the fieldstaff and television broadcasts to market complementary products: *"The big step up in joining Agvision is that the fieldsmen can become professional and work 52 weeks of the year because they have so many options to offer a farmer now, so many different commodities where they can earn a commission"* (FY). The product range was planned to include ear tagging, pensions and other complementary products. *"We have given them an implicit promise that when we get to a stage where we identify the field officers that we really think are going to be part of this system they will be given a franchise and they will have their own business"* (Ian Smethurst.). It was not expected that these franchises would be tied to specific areas (IS). ANM aggressively sought agents to procure stock for selling on the Agvision video auction including Borders Livestock Exchange, a firm established by fieldsmen who had left DIRECT, and Caledonian Marts in Stirling, who had sourced stock for the CLASS auction. With the growing availability of satellite television ANM saw potential growth in selling store stock on the satellite auction, with farmers viewing the sales at home. The satellite system is marketed to farmers on the basis that they will also be able to receive Sky television. Farmers using the satellite system tend to be large finishers, with a throughput of over 200 cattle a year (EG).

The lack of technical sophistication of the EASE system was not seen as being a problem by Midland Marts: *"The EASE system is not the slickest, it is adequate. It doesn't matter how slick the system is, it is only as good as the relationship that the field officer has with his client"* (IS). Yeo claimed that fieldstaff needed three requirements: *"Commitment, an ability to describe stock accurately and be good*

communicators: the most successful ones are good communicators” (IS). In 1996 Smethurst predicted that in 1998 the cost of satellite time would fall to 25% of its 1996 level when satellite broadcasting becomes digital. To enrol farmers wanting to buy store stock the selling of the satellite system was packaged through a national installer which included subscription to Sky Television for £400 (IS). Jones, based on his experience with CLASS, was not optimistic for the future of Agvision, believing that it could lose £1M in four years before reaching a level of sales at which it could make money (DJ).

### **Defection of Assessors**

The contacts which the fieldsmen have with the farmers and the importance of their reputation for buyers created a temptation for fieldsmen to set up independently as brokers negotiating between farmers and abattoirs. This was most clearly seen in 1995 when three fieldsmen left County Auctions of Wooler, the operator of DIRECT, to set up a rival livestock marketing operation. Brian Ruthven, James Logan and Logan Burn formerly worked as fieldsmen for County Auctions procuring stock for EASE and then for DIRECT. On 19 June 1995 they formed Borders Livestock, based in Kelso : *“We have all been in this industry since we left school and I would think 90% of our business came with us”* (BR). Ruthven argued that this was because for the farmers using DIRECT, it was the fieldsmen that they were in contact with and were trusting to sell their stock, not the auction company.

During their time with County Auctions they had learnt the potential benefits of selling on description in time and cost savings: *“The strength is just that the farmers like it in that you can go and select stock and give them a price within reason and it is all sold on the EURO-grid, the cattle is flat rate, but you can value stock very accurately, to the penny many a time, whereas you take them to the live market, they have haulage costs, uncertainty about what the trade is going to be, commission is less, and obviously stress and the new haulage regulations are beneficial to the system”* ( B R). On prime stock Borders operate telephone and fax auctions, while on store stock they use the Agvision satellite auction. On prime stock Borders identify abattoirs’ requirements and draw stock to meet these requirements: *“We sell the stock to the highest bidder, but we also can recognise difference between abattoirs. On fat level gradings are supposed to be the same, but there is a vast difference between what one abattoir calls a 3L and what another calls a 3L, so when we draw sheep from the flock we can put the fat sheep to the men that like the thicker end of sheep and the lean ones the leaner end”* (BR). Borders’ commissions are 2.5%, or £1 per head on sheep below £40. which Ruthven argued was *“very competitive with regards to what livestock markets charge around here, 3.3%. The farmers also save the transport cost which can be £10 on a “beast” and 70p on a lamb”* (BR).

It was reported in the Scotsman (Buglass, 1995) that Borders Livestock Exchange was selling 6000 lambs and 250 cattle per week, which was higher than their expectations. Logan Brown described satellite selling as the future of livestock selling: *"We are confident that the quality Border and Northumbrian store cattle will find a ready market sold on a direct farm to farm basis and weighed at the producer's nearest weighbridge with all the welfare and cost savings entailed."* (L. Brown) Buglass reported that Borders believed the "modern generation" will increasingly use professional brokers instead of auctioneers to match buyers and sellers (Buglass, 1995).

Borders were approached in 1995 by Sandy Wright, ANM's general manager, who knew them as EASE fieldsmen to procure store cattle for Agvision's satellite auction. Instead of predicting dead-weight, fat level and conformation, they video the cattle and summarise its history. Agvision commission is 3%, with 1% coming to Borders for describing the stock. Brian Ruthven argued that video did not give a good indication of sheep: *"You could film a field of sheep looking tremendous, but they could be as fat as seals"* (BR).

### **Collapse of APEX Ltd**

By 1995 APEX UK appeared to be by far the most successful electronic auction franchise in terms of the numbers of livestock sold. However, because of their policy of operating with very slim margins and using a large fieldstaff, they were losing money. In 1995 APEX UK approached LEAN. APEX wanted LEAN to sell their stock on APEX. J Thomson recalled that: *"with no guarantee that they would take over stock in three months' time. It was a very odd meeting, quite the oddest I have ever been at. We had a pleasant day out, we were very well fed and wine and dined. The same in Aberdeen, most hospitable"* (JT). In 1995, Yeo, the general manager of APEX Ltd, left to join Midland Marts to develop Agvision and Colin Young took over as manager. Young attempted to reduce the costs of APEX Ltd.'s operations, cutting back on the number of fieldsmen and controlling the discounting of commissions. A company with interests in dead-weight meat trading expressed an interest in taking over APEX Ltd's operations but this rescue fell through when the BSE crisis led to the collapse of cattle selling. In May 1996 APEX Ltd was placed in receivership. When APEX Ltd collapsed the major losers were their shareholders who lost over £1M, with other losses by APEX UK, farmers and BT. Initially the publicity surrounding the failure affected APEX Scotland, the Montrose franchise, but more significantly it was seen by Lind as making it difficult to re-franchise the system in England under the APEX name (JL).

The collapse of APEX Ltd. left APEX UK with no franchisee in the whole of England, solely using their system to sell cattle for APEX Scotland, the Montrose franchisee, and milk in Northern Ireland. Lind's

strategy by spring 1997 was to leave the development of APEX until the cattle market recovers. He claimed that the pressures for improved animal welfare and traceability from the multiple grocery chains will create a niche for electronic selling. He believes that 70 - 80% of stock will be sourced directly by abattoir buyers with the remainder being sourced electronically (JL).

### **Further Developments by Newline**

In summer 1995, following the demise of CLASS, Jones was planning his own video auction using telephone lines and hardware video decompression: *"I am doing this in a surreptitious way because I don't believe the time is right to take on the vested interests of all those markets, because they kicked me up the arse the last time"* (D Jones). Jones viewed existing live auction operators as being violently competitive with each other which made building a network of users difficult - *"they are like pirates."* (DJ). According to Jones abattoirs are financially weak, operating on narrow margins. British Beef, a subsidiary of Vestey, went bankrupt in 1995. Newline's credit monitoring service forecast their collapse, but many markets could not believe such a well established firm could collapse, and lost hundreds of thousands of pounds (DJ). An abattoir, Mills Quality, was forced by the European Commission regulations to upgrade its facilities and went bankrupt. Winterton's of Lichfield were owed £425,000 which was not insured, forcing them to seek a buyer for the business, after investing heavily in the building of a new market in 1988.

Jones' plan in 1995 was to sell stand-alone electronic market systems to individual auctioneers. Lots could then be offered dead-weight on each market operator's computer system with abattoirs allowed access to bid for the lots. Conceptually this is similar to the CALM Exchange in Australia. Auctioneers would have the facility to link their auction when they agreed. This would take away from the system developer the responsibility for running the market and would also overcome the need to build a network of auction operators. Jones was sceptical about auctioneers' ability to build networks: *"I can't see them working in groups any other way because the BEACONS and EASEs are not groups, they are just loose individual franchises"* (DJ). The abattoirs would be able to download pictures and bid using a grid to compensate for misgrading. Lots would be advertised with a definite sale price and a reserve price. Jones saw the advantage of this system compared to existing electronic auction systems would be the lower overheads and the greater flexibility for auctioneers and buyers, with buyers connecting the system whenever they wanted to place bids (DJ).

### **Building the United Kingdom Electronic Livestock Auctions Networks**

The history of the British systems described is one in which between 1989 and 1995 electronic marketing evolved from a concept which was widely believed might halt the decline in competitive markets into a minor trading channel when compared to direct sales and live auctions. From an ANT perspective it is trivial to note that the adoption networks were not stabilised, following the pattern observed in the United States and Australia. The British networks were distinctive in that five competing but functionally similar networks formed, in opposition to the claim in Bakos (1991) that electronic markets will tend towards being monopolies.

The earliest attempts to establish electronic markets in the United Kingdom livestock sector were initiated by firms who saw an opportunity to displace existing intermediaries who each realised the need to enrol existing auctioneers as a link to farmers because of the difficulty of enrolling farmers directly into their networks. The earliest attempt to establish a market, TABROTEC, was initiated by a farmer who perceived a lack of competition in the pig industry which he combined with an amateur interest in the uses of the Prestel teletext system. He enrolled GEC in the conception phase and a small network of buyers and producers in the adoption phase. However the growth of the network in the adoption phase stalled when he was unable to enrol auctioneers into the network to draw in more producers. Istel personnel problematised electronic markets as a use for their network infra-structure, with social linkages to a farmer providing an awareness that electronic markets could be problematised to the livestock industry as a solution to the perceived lack of competition. The Istel system was abandoned during the conception phase when it was realised that Istel lacked the expertise to build a network of agents to source stock and that existing auctioneers would not be enrolled into a system controlled by a third-party. Istel's experience was duplicated later by Lysis, a smaller IT company. For Lysis the conception phase was simplified by emulating the Canadian OLEX system, but as with Istel Lysis were unable to enrol existing auction companies to source stock for a system under the control of a firm from outwith the industry. The one example seen in the United Kingdom of a system owned by a firm not directly involved in the livestock trade was CLASS. Jones attributed his success in enrolling a network of existing auctioneers to source stock for the CLASS satellite system to a panic amongst existing auctioneers who had been left out of the electronic market networks and, fearing they would be successful, wanted to offer remote selling of livestock on the basis of description. The CLASS system network was unstable, with a lack of trust between Jones and some of the auctioneers involved, leading to the failure of the company and the system being taken over by Midland Marts, the operators of Banbury market. Similarly to gain the acceptance of auctioneers ownership of Lysis' system, LEAN, passed to a consortium of auctioneers before it reached its adoption phase.

The licensing of the Ontario OLEX system for use as EASE in the United Kingdom by ANM was the key event in the development of electronic livestock selling in the United Kingdom, triggering the growth of the competing networks and providing them with a template. The conception phase of the EASE network was simplified by licensing an existing system. This simplification went beyond removing the need to develop the system's technical elements, providing an example of the operation of the same system in Canada to overcome doubts about whether electronic selling could work technically and imply that it could work commercially. EASE's conception phase was also simplified by enrolling familiar auction mechanisms and grading systems. The Canadian system followed the structure of the live market, with a sequential English auctions of lots, and the compensation system merged the Canadian compensation scheme with the existing mandatory European carcass classification system. For Lind of ANM Group the electronic auction appeared to be a solution to the inexorable decline in the proportion of slaughter stock passing through live markets and the growth of abattoirs buying direct from farms. Lind was very successful in using this argument to enrol other auctioneers, claiming that that EASE was the answer to this strategic threat to their live markets. However, this decline in live markets was not a threat to abattoir buyers, who it was believed gained greater control of sourcing in direct buying. It was believed among many auctioneers that pressure for direct buying was also coming from multiple retailers who wanted direct sourcing on animal welfare grounds. Electronic auctions offered auctioneers a means of maintaining their business by auctioning stock for direct delivery from the farm to abattoir. ANM Group chose a structure of regional franchises for EASE, maintaining their control of the system, based around franchisees buying the sole rights to operate EASE auctions for stock in defined areas. Potential franchisees were aware that if they did not take a franchise on ANM's terms they would find a competitor taking an EASE franchise in their area. The network of EASE franchisees became a mix of existing auctioneers, who had at least in part taken the franchise to prevent a competitor taking it, and entrepreneurs with experience of trading in livestock who took the gamble that ANM's predictions for the growth of electronic trading would prove accurate. By tying franchisees in the EASE network to small local areas EASE enrolled a nation-wide network in which the franchisees had close existing relationships with the farmers they would be targeting to source stock from. However, this structure also had the weakness that in sourcing stock for the electronic auction the franchisees who were also operating live markets might displace stock from their live markets. The interest amongst auctioneers in taking EASE franchises created a large number of existing auctioneers who were afraid that EASE's sanguine predictions for electronic selling would prove correct but who had been unable to agree ANM's terms so faced competition from a local EASE franchisee. The links between these firms led to the formation of the BEACON and LEAN electronic auction networks, catalysed respectively by a group of auctioneers who

had been unwilling to accept EASE's terms, in particular being hierarchically subservient to ANM Group, and by Lysis, the computer software firm with strong links to auctioneers through supplying auction administration systems, seeking to market their own auction system. Both BEACON and LEAN did not follow the hierarchical structure of the EASE network, instead setting up collaborative networks in which all system operators had an equal stake in the system.

EASE system formed the template for the technological elements of the following electronic auction systems, except for the CLASS satellite auction system. All used the BT Dialplus service for buyer connection, with buyers connecting using personal computers. The auctions all simulated the live market.

While the EASE network was itself largely constructed from existing technical and social components, it also provided a model for the following systems. Emulation of EASE simplified the conception phases for LEAN, Direct and Beacon, although in each case requiring the enrolment of IT services to develop the software. The conception phase of APEX was simplified by licensing the NEMI system, which was also functionally equivalent to OLEX/EASE. This emulation of EASE further simplified the adoption phase for BEACON, LEAN, APEX and Direct because EASE had created awareness of electronic markets amongst both farmers and abattoirs. However, the conception phase allowed the systems following EASE to address the weakness identified by actors both inside and outside the EASE network: its hierarchical and localised franchise structure which was believed to limit the incentive of operators to market the electronic auction aggressively. The BEACON system was initiated by a group of auctioneers who had been translated by EASE into auctioneers with an interest in electronic markets, but were unwilling to accept the conditions proposed for the EASE franchises. The LEAN system was initiated by a computer software firm with links to the auctioneers, but in order to enrol auctioneers frightened of becoming tied to a system owned by a third-party, ownership of the system passed to a consortium of auctioneers. Therefore, when the director of Lysis sought to translate the auctioneers into a source of livestock for his system, they counter-translated Lysis into a provider of IT resources for the system.

Lind, having gained experience in the operation of electronic livestock markets with EASE, learned of the existence of the NEMI system in use in the United States. From his experience with EASE he realised that the local franchise structure of EASE was a weakness, with auctioneers inhibited from aggressively marketing electronic selling because they believed it drew stock from their live markets. The conception stage in APEX was simplified by licensing the NEMI software and adapting it to mirror the EASE use of the EURO grid and by enrolling personnel with EASE experience. The adoption phase was simplified by only licensing two franchises and by APEX Ltd enrolling personnel with EASE experience to build a national network of fieldsmen quickly. The APEX network therefore translated software, expertise,

fieldsmen and grading processes from EASE. Even the innovation in structure was embodied in Lind and therefore came from the EASE network. Similarly, the genesis of DIRECT followed from the breaking off of a sub-network from EASE, in this case one of their franchisees. Forbes, with County's fieldsmen, enrolled a system developer with experience in the livestock industry to develop the DIRECT system emulating EASE.

The one system described in which network formation was not simplified through emulating EASE was CLASS. However, CLASS did follow the pattern of enrolling existing elements and exploiting existing social links. Jones already had the IT expertise and links in the livestock industry to provide a foundation for CLASS. Jones enrolled Plymouth University's expertise in satellite television and emulated the American Superior satellite system to simplify the conception phase. The CLASS conception phase was complicated because CLASS could not draw on the EASE user base, requiring abattoirs to set up satellite receivers and accept video descriptions. Greater effort was required to translate abattoirs into bidders with the satellite receivers than was required to translate bidders using EASE into users of the similar BEACON, LEAN, APEX and DIRECT systems.

#### **Failure to Stabilise the Networks**

While the successful translation of existing elements ensured EASE, BEACON, LEAN, CLASS, APEX and DIRECT completed their conception phases, unlike Istel's system or TABROTEC, the failure of the systems to achieve levels exceeding 6% for cattle and 15% for sheep and their falling market shares implies that the networks were unstable, with the networks splintering as fieldsmen, auctioneers and abattoirs either dropped out or reduced their involvement. Following an ANT analysis, this was a failure to complete the translation of these entities. While the operators of the systems sought to translate farmers into suppliers of livestock for the auctions, the systems acted as a mechanism for abattoirs to enrol farmers into their direct procurement networks. Where a buyer was satisfied with the stock bought from a particular farm electronically the linkage created could be exploited by the abattoir in future by directly contacting the farm. Fieldsmen were enrolled to represent the systems to farmers, but as operators switched from full time fieldsmen to part-time fieldsmen they were increasingly willing to broker direct deals between farms and abattoirs based on their personal connections. Abattoir buyers were enrolled into the networks to bid for the livestock, but many abattoirs saw the systems as means of monitoring prices and locating sources of stock, being unwilling to become dependent on the electronic systems. Therefore, while the operators of the system were successful in enrolling fieldsmen, farmers and buyers, their behaviour showed that many of them had not been translated to take on their envisaged role in the nascent networks.

The high cost of the DEC VAX machine required for running the EASE system had been seen as a major barrier to anyone planning to set up a rival system. However, the rapid growth in the power of personal computers in the late nineteen eighties made systems based around personal computers feasible at much lower capital and software cost. This cost fall made the establishment of the BEACON and LEAN systems feasible when the costs were spread across their membership. DIRECT and APEX were founded by people who had experience of EASE operation but realised that its network structure was a barrier to its long-term success. County Auctions realised that the terms of their EASE franchise were restrictive and that it was financially justifiable to own their own personal computer-based system, DIRECT. John Lind, who was instrumental in the setting up of EASE, saw that if the PC-based NEMI system could be licensed at a reasonable price the lower cost of personal computers would enable him to set up a rival system, APEX, with a much lower cost base than EASE and avoid the mistakes in the structure of the network made with EASE. Lind set up APEX with only two main franchisees, who again were both existing livestock auctioneers. Lind believed that the commitment of these franchisees would be stronger than had been seen in the EASE network and that it would give the franchisees an incentive to develop a network of fieldsmen to source stock from outwith their local area where they would not be inhibited by the danger of displacing stock from their live markets. To construct the APEX auction network Lind appropriated elements from the EASE network, including the two other directors who had been responsible for the technical and financial aspects of EASE. APEX Ltd in Rugby then further appropriated two further successful elements of the EASE network by enrolling Yeo and Young, both EASE franchisees, and the majority of their networks of fieldsmen.

When EASE had enrolled buyers into the network they had to persuade them to buy modems and in some cases personal computers and also to educate them in the use of description-based selling with EURO-grid compensations. The existence of this network aided the following systems in appropriating this network of buyers because all the systems also used BT Dialplus and, except for BEACON, grid-based selling. To build the rival CLASS video auctioning network it was necessary to persuade buyers to install satellite receivers and televisions, which was attempted by bundling the satellite system with Sky television subscriptions. While from the system operators' perspectives the abattoir buyers were being enrolled into their electronic auction selling networks, for the buyers the electronic selling systems became another element in their own networks for sourcing stock. The abattoirs' investment in building networks of direct buyers and buyers in local live markets limited their use of electronic buying.

In each system the role of enrolling sellers into the system networks was devolved to the operating companies, except for awareness campaigns when the systems were launched and very occasional advertisements alongside articles on electronic selling in farming journals. More specifically, the role of

enrolling farmers fell on the operators and franchisees networks of fieldsmen. Fieldsmen had a dual role, to assess the stock and to market the system to farmers. The farmer's sole contact with the systems was in practice the fieldsmen and they viewed the fieldsmen's expertise as important in securing a high price on the electronic system for their stock. Where fieldsmen moved between systems or auctioneers switched systems taking their networks of fieldsmen with them, networks of farmers would be excised from one system's network and grafted on to the other. To enrol farmers it was seen as necessary to make selling electronically as risk-free as possible, leading to there being no penalty for a farmer listing stock on the systems, setting a high reserve and withdrawing the lot if the price was not made. Having no penalty for withdrawing stock simulated live auction practice, but in the live auction the cost of bring the stock to the market and returning with them unsold creates a pressure for sellers not to set unrealistic reserve prices. Without this penalty, farmers were tempted to put stock into the electronic sale speculatively with a high reserve, undermining the confidence of buyers and incurring the operator the costs of assessment for no fee.

The social networks within which the United Kingdom auction systems developed were therefore complex and unstable, with actors switching between systems. However, one general observation can be made. Although six systems appeared each of them was constructed from pre-existing social network elements, whether by enrolling existing auctioneers, emulating the existing auction, drawing on the existing system of carcass classification and seeking compatibility with existing systems.

## 7. Fish Markets

*Chapter 7*

*Fish Markets*

## **Introduction**

This chapter covers the development of remote bidding electronic fish auctions. The first electronic fish auctions were introduced in Holland and they emulated the clock auctions seen in Dutch vegetable and flower auctions. In a Dutch auction lots are offered at a high price, then the price is progressively lowered until someone bids. While Dutch auctions developed in the Continental agricultural industries for idiosyncratic reasons, it will be argued in this chapter that the split between English and Dutch auctions has led to the emergence of two contrasting approaches to electronic market development. In the livestock industry electronic auction systems discussed in the preceding three chapters the electronic market was seen as an alternative market channel, but in Dutch auctions technology has been used to link existing markets and then open them to remote buyers.

This chapter describes the growth of SCS, the leading supplier of electronic fish auction systems, an unsuccessful attempt to introduce an electronic fish market in Scotland, the emergence of two competing fish auction systems in Iceland and two rival projects to develop pan-European networks of linked markets.

In Iceland two electronic markets have emerged linking networks of fish markets. The success of these systems may be ascribed to the close community in the Icelandic fish industry, enabling traders to rely on descriptions provided by the boat skippers. However, in the United Kingdom the introduction of electronic fish auctions has been prevented by the complex structure of the industry, with large numbers of fish selling companies auctioning fish in the major markets, and the use of an opaque market to disguise breaches of quota regulations. The chapter includes a study of the attempt to introduce an electronic market into Lochinver and Kinlochbervie harbours in Scotland, in which the local government proponents could not overcome objections from traders. This is contrasted with Iceland, where in ten years they have evolved from having no markets to having two competing networks of electronic markets. The comparison shows the difference between building upon a close community compared to a wider community of lower trust relationships.

Finally, two projects to develop pan-European electronic fish markets are described. The European Commission funded INFOMAR project is compared to the system being developed by Zeebrugge fish market. While the INFOMAR project started with a radical vision of selling fish electronically off boats in a pan-European market, the Zeebrugge project is a more incremental vision to link markets to build a pan-

European network of existing market. It is seen that the two projects have converged due to the complexity of the European fish industry leading INFOMAR to operate through existing markets.

### **Continental Markets for Agricultural Produce**

In the nineteen thirties Copenhagen was the leading Danish fruit market, but it suffered from poor prices being achieved for buyers if, by chance, the market was flooded with fruit. Sellers could not return the fruit to their farms. A Rand, Director of Fruit and Vegetable Auctions in Copenhagen, introduced sale by samples, in which a representative crate of fruit and a statement of total quantity were presented to potential buyers. After the sale the vendor forwarded the fruit directly to the buyer. To attract as many buyers as possible auctions were held simultaneously in Copenhagen and Aarhus, linked by telephones and using public address speakers to broadcast the auction to buyers. During the war the system was not used, but it was restarted in 1952, extended to include the market in Odense, using teletype machines to link auctions. Sample boxes of produce were displayed in the auction halls in Copenhagen, Aarhus and Odense, with bidders bidding by pressing a button at one of the locations. The auction method was an English auction, with the bidder pressing a button to register their bid with the auctioneer. The seller paid 3% commission and the system was described using the Danish Ministry of Agriculture's quality specification. In 1954 there was a plan to extend the synchronised auction beyond apples to include potatoes (Meissner, 1954).

However, the countries in which electronic marketing developed most rapidly were Belgium and the Netherlands. In the Netherlands and Belgium there is an established tradition of auctioning agricultural products. Vegetable auctions operated by producer co-operatives first appeared in the Netherlands in 1887 and by the nineteen fifties there were 170. The auctions are co-ordinated by the Central Bureau of Fruit and Vegetable Auctions in the Netherlands (CBT), which was formed in 1917 to standardise trading terms. The CBT ensured that across Dutch vegetable markets a standard system of produce grading and description was in use. By 1992 the market had become increasingly concentrated, with only 21 markets still operating (Mansell & Jenkins, 1992). The traditional mechanism is a falling price Dutch auction in which the auctioneer progressively lowers the offer price until someone bids. In approximately the year 1900 mechanical auction systems were introduced manufactured by van der Hoorn and Wouda, Utrecht (Cassady, 1967), some of which were still in use into the 1960s. In these mechanical auctions the buyer had a button and, as the lot price fell on a mechanical clock, the buyer who first pushed his button bought the lot at the price shown on the clock (LS).

In 1983 a teleauctioning system was introduced linking vegetable markets in Belgium, using telephones to link bidding in markets. Following this the Dutch markets at Bleiswijk and Utrecht commissioned a

software house, COVAM, to develop a system, Televier, to link electronic clock markets. This system became operational in January 1984 linking Bleiswijk and Utrecht. By 1992 Televier was linking six auctions with a turnover of £312,000,000, representing 20% of the Dutch vegetable produce market (Mansell & Jenkins, 1992). While automation in Dutch auctions was first applied in vegetable auctions, flower auctions are more significant, with the value of flowers auctioned in Holland being three times that of vegetables. In 1996 the Netherlands traded 59% of the world export market in cut flowers (van Heck & Ribbers, 1997).

### **Schelfhout Computer Systems (SCS)**

In Europe there are six firms selling electronic auction systems for the fruit, flowers and vegetable markets, but over 80% of the market is held by Schelfhout Computer Systems (SCS) of Stekene in Belgium and Nieaf-Smitt of Utrecht, Holland. Nieaf-Smitt specialise in a small number of large projects and SCS in a larger number of smaller projects. Nieaf-Smitt's biggest customers are Dutch flower and vegetable auctions, including the biggest at Aalsmeer. The two firms generally are competing for the same customers and are represented at the same trade shows in the agricultural and fish industries: *"We meet each other very often and it is always fun to meet them"* (LS). Nieaf-Smitt is a direct descendent of van der Hoorn and Wouda, the original makers of mechanical auction clocks. Nieaf-Smitt supplied the internal auction clock systems into the Dutch vegetable auctions, with VABA supplying the interconnections, but in flower auctions both Nieaf-Smitt and Schelfhout supply complete systems.

Luc Schelfhout, the founder of SCS, was brought up in a vegetable farming family in northern Belgium. After graduating from university with a degree in computer systems, he saw an opportunity to use computers to automate the auction mechanism in Belgian vegetable auctions and in 1983 he founded Schelfhout Computer Systems. His first electronic auction was a vegetable market at Roeselaire in Belgium. Some of the buyers in this market had dropped out due to bankruptcy and the market sought to use IT to link markets together. From 1989 Schelfhout have been marketing electronic auction systems across Europe, specialising in systems for perishable agricultural products: *"The problem is if you have roses or fish, you have to sell them, you cannot put them back. That is different to livestock"* (L S).

In continental vegetable markets producers bring their products to a central market where the sale is generally organised by producer co-operative. The producer co-operatives set up auctions to protect the interests of their small grower members relative to the large wholesales. First the buyers inspect the lots to check that descriptions are accurate and then go to the auction room where the auctioneer uses the falling clock to auction the lots in rapid succession. For the auctioneer the use of auction puts pressure on buyers to bid the best price as soon as possible. The speed of auctioning using an auction clock is also an

advantage for buyers, with lots being sold much faster than in an English auction. SCS have produced clocks handling 2000 lots per hour and in 1996 were building an auction system for the VBA Almeer flower auction in the Netherlands that would handle 3000 sales per hour. Luc Schelfhout believed that the speed of auctioning increased prices: *“if you put pressure on the market you get higher prices, buyers have less time to think and probably pay a higher price.”* The auction systems also carry out the administration of the auction and the printing of delivery notes.

Luc Schelfhout argued that electronic markets were becoming more attractive to market organisers because increasing concentration in markets was weakening traditional intermediaries: *“On the producers’ side in agriculture, horticulture and fishing there are fewer larger producers. On the other hand, if you look at the buyers, there are less and less players, they become bigger”* (LS). These changes have reduced the numbers of intermediate wholesalers, making the supply chain more responsive and reducing the margins which can be made by intermediaries. Luc Schelfhout also argued that prices paid to producers in these vegetable markets had been falling, due to the growing power of major retailers and produce coming in from a wider range of sources:

*“A friend of mine grows pot plants. He specialises in growing Brothermaheras. He is selling them to a wholesaler in Belgium, who is selling to another wholesaler in the United Kingdom, who is finally selling to a big supermarket chain. I tried to trace the plant back to the grower. Marks and Spencers sold the plant in their stores for £5.00. So the consumer comes, picks up the plant, goes to the cashier pays £5.00 for it and he goes away and Marks and Spencers have the money. Marks and Spencers had made a deal with the United Kingdom wholesaler, Blackwell. Marks and Spencers say “okay you deliver me next week x hundred thousand of those plants. I want them that size, with that pot, with that package, you will put my label, bar-code and price on it, so then for Marks and Spencers it is very easy -they just put in on the shelf. The price that Marks and Spencers agreed with Blackwell was £2.00 and Marks and Spencers pays after 60 days. So we see already that there is a big gap in added value due to the price change and the payment delay. Then Blackwell goes with that order to a wholesaler in Belgium and says “I need plants meeting this specification”, and then the Belgian wholesaler goes to a grower who can deliver it. The grower gets paid the equivalent of 50 pence four months after delivery. Because of oversupply, the grower has no choice - if he says no somebody else will supply them. They are in a situation now that they can hardly survive at that price, some of them are going out of business, the economic situation for them is very bad. In this cases we do not have an efficient transparent market. You have a dominating position on the market for one group, in this case the supermarkets, who can dictate the price and take advantage of a more or less monopoly situation to make an extremely large margin. This market structure gives great power to the large purchasers. We see ourselves not as being a computer company, although*

*we build computers and supply software. Our customer, the market organiser, comes to us because we are market architects”(L Schelfhout).*

For Schelfhout, the benefit of electronic auction systems is to make the market more competitive and more transparent. From his roots in the agricultural sector, Luc Schelfhout also saw electronic auctions as a means of defending the position of smaller scale producers in the face of international competition: *“So the answer is to make your market more competitive, more transparent, and try to keep the added value on the production level as much as possible”* (LS). Schelfhout claimed that the *“market is information”* and the aim in designing auction systems is to communicate to buyers the range of products available and to producers the requirements of buyers. In the more efficient market Schelfhout believed that there would be fewer players, with intermediaries squeezed out of the supply-chain.

Prior to the 1990s most Belgian produce markets were small local markets. Northern Belgium had twelve vegetable auction rooms working independently with 100 buyers in each. A wholesaler needing products from each market needed to have a buyer in each auction connected by telephone with a central office coordinating buying. Schelfhout have reorganised the markets so that a buyer physically at one of the auctions has access to all the markets. This reduces the number of buyers required to cover all the markets from 13 to 1.

*“If you have 2 markets which are completely separated with buyer and producers in both trading in a perishable commodity, you can on any day have a shortage in one market, and high prices, with a surplus and low prices for the same commodity in the other market. The next day the prices may be the other way round. This causes uncertainty for producers, but it also adversely affects buyers. Wholesalers will be buying from the buyers in both markets. The wholesaler will know the price in the market that the buyer bought in and bid them down on that basis, while using the existence of lower prices elsewhere to push the prices down for the buyers who paid the higher price. If you link those markets together, then you stabilise it, you make it equal. Stable market prices are good for both the producer and the buyer. What the buyers don't like is that the markets will become more transparent, more open. The information will become more available on what the market situation is so it will be more difficult for them to make a high profit on it. The buyers become more and more handling agents who buy the product and takes a commission on it, transport it and deliver it to this customer. So we have done that in Belgium with the 12 vegetable markets.”* (Luc Schelfhout)

The twelve vegetable markets were linked together by computer links in 1985/86. Some of the markets initially stayed out of the network, believing they were strong enough to stay separate. However they found that because the linked market was a stronger more stable market than an isolated market, producers

started to shift their stock to the linked markets, so they belatedly joined the network. There may only be five buyers in each auction room but each one can be buying from all twelve physical markets.

Having developed systems to link markets, the next step was to remove the local wholesaler who, for example, buys in local Belgian markets then sells to a wholesaler in the Paris Rungis vegetable market. They could be bypassed by allowing the French wholesaler to buy directly off the system in the local market. SCS have introduced this in Denmark at Odense. A remote market requires accurate description, because the buyers will be less aware of the reputation of sellers. The Euroclass vegetable classification system grades vegetables in terms of size, quality and colour. While European standards exist for vegetables and fruit, flowers have been found to be more difficult to describe accurately because of the huge variety of species, sizes and colours. To a lesser extent fish have also been difficult to describe reliably because the principal factor in determining the value to a potential buyer is the fish's freshness. Luc Schelfhout accepted that there is a lot of work required develop a fish classification system reliable enough to create efficient remote fish selling.

The Danish co-operative GASA Odense approached Schelfhout in 1989. A new director saw that there would be benefits to GASA in opening the market to remote buying. Schelfhout claimed that this appointment overcame the conservatism which affects many markets: *"a big problem that you have in changing markets is tradition..... you will have a lot of friction or people that don't want to change"*. GASA came to Schelfhout wanting a system which was open, where buyers not only from Denmark, but also from Norway, Sweden and Germany could buy. GASA Odense's objectives were: to make it possible to participate in the auction remotely; to give the trade improved information on the availability of Danish fruit and vegetables; to ensure that the price structure was based on supply and demand; and to improve the efficiency of distribution, giving fresher produce to the consumer (Schelfhout, 1995). Each purchaser required a personal computer linked using the Datex-network to Gasa's central computer. The aim was that supermarket chains from across Europe could buy directly, by-passing wholesalers. The system started out on a small scale with only two buyers, but by 1996 had 48 buyers in five countries, with 80% of the products bought remotely.

Luc Schelfhout saw the greatest area of growth for electronic markets as being in trading futures. This, he said, requires quality standards, an information provider and a market organiser, the equivalent of a clearing house in financial markets, which clears transactions, sets up the rules and guarantees any payment. To create an efficient electronic market Luc Schelfhout argued that it should be done incrementally: *"If today you want to go from one extreme to another, from a not organised, not transparent market with a lot of Mafia around it, to the ideal, it is not possible. Go step by step, taking a*

*lot of years. If you have a market, then start a local system to improve it. Then link to outside markets to widen the market, and then make it possible for buyers to buy from. To buy from home you need descriptions, you need an organiser who can guarantee that the descriptions are reliable, so you need quality controls. When you have that you are near to creating an efficient market.” (LS) Schelfhout sees SCS as system suppliers: “We will never be a market operator, we go to parties who can be market operators and we say we have the know-how, we have the experience and we have the solutions; buy from us.” (LS)*

SCS produce systems tailored to the needs of customers: *“We try to understand what the market needs, what the mentality is, we tailor it to make it more acceptable and then it starts living its own life, because markets are not static, markets evolve, so a system should evolve as well,”* with system users returning to seek enhancements to their systems. SCS analyse the needs of potential customers and produce a functional analysis. Sometimes, as in the case of a system sold to Scottish Milk, a demonstration version was produced. SCS’s relationship with Scottish Milk is typical: SCS sought to sell Scottish Milk a system, whereas APEX UK, the operators of the United Kingdom electronic livestock market sought to operate the market and be paid a commission on sales. *“How can you promote efficient market systems if you want to operate the market yourself? Then you have a conflict of interest.” (LS) Schelfhout supply the system and the customer can then use it to sell whatever they want.*

This strategy has led to SCS developing systems incorporating a wide range of auction mechanisms and technical standards for interconnection. In some SCS systems buyers bid and, if successful, decide how much of the available items they want, as seen in Scottish Milk, whereas in other cases lot sizes are predetermined. Of SCS’s auction systems, 80% have been Dutch auctions and 20% English rising price auctions. Fish are generally sold on a rising price system, because this is the mechanism used in traditional “shout” fish auctions. Electronic continental meat, cattle and milk auctions tend to use a falling price Dutch auction, again because this is the mechanism buyers are familiar with.

### ***Technical Background to SCS Systems***

SCS systems use personal computers incorporating their own proprietary *Syncrator* synchronisation board to ensure that the clocks in each computer are synchronised and to ensure that the first bidder to bid is identified as the successful bidder, irrespective of data network delays. This synchronisation is particularly important in Dutch auctions, where otherwise bidders bidding remotely with network delays would be at a disadvantage. Beyond this basic architecture Schelfhout offer a wide range of data network and auction mechanism options. Schelfhout have developed systems using a wide range of communications protocols. Early systems used dedicated telephone lines, then they moved on to offer X21, X25, X400 and ISDN. By

1996 ISDN was Schelfhout's first choice for linking remote buyers. The use of ISDN allowed the transfer of larger quantities of data than the earlier systems. Schelfhout had implemented a system in Denmark for GASA Aarhus in which ISDN is used to send data, audio and pictures for a flower market. The system uses a video conference system standard. They bought a video conference system and have adapted the software so that it is integrated into the auction programme. The buyer sees the clock, the information describing the lot and an image of the lot simultaneously on screen: "*The value of pictures is that they help to make people accept the system*" (LS).

### ***Markets for Fish***

Fish is a commodity sold by auction throughout the world. As with livestock auctions, the structure of the fish industry is for a large number of boats to sell their fish to a smaller number of processors in local markets, usually at the harbour where the fish is landed. The buyers are looking to meet their requirements by buying in a number of markets, but the seller, once the fish is landed, has little option other than to sell to someone in that market. The volumes of fish landed are influenced by the luck of the boat and the weather, leading to price volatility and price variations between markets. The use of electronic clock auctions, developed for vegetable and flower markets and described in the previous chapter, when linked to the automated processing of transactions, speeded up the sale and reduced the cost of auction administration. In Continental European markets the practice of selling fish by the individual box made the introduction of electronic auctions more attractive than in the United Kingdom, where the standard practice is to auction all the boxes of the same species and size off a boat as a single lot. The number of lots needing to be sold in the continental markets led SCS to develop the Moby-Clock, an electronic auction clock mounted on a battery powered vehicle which could move through the auction hall. The availability of widely disseminated market price information has led to a growth in direct selling between the boats and agents acting for the processors. In some smaller ports, for example Ullapool in Scotland, there is no organised fish auction.

SCS's first installation of an electronic fish auction was in Zeebrugge in 1987. The market had been privatised and was being run by a private company whose other activities were outwith fish auctioning. They invested £19 million in a new fish market and sought to change radically the marketing of fish and become Europe's leading fish port by opening up access to anyone. Zeebrugge had the locational advantage of being well connected by road to the cities of northern France, Belgium, the Netherlands and western Germany, but was restricted by the low volumes of fish landed into Belgian ports - in 1988 Belgian landings were only 37,000 tonnes out of total Western European landings of 9,702,000 tonnes (FAO, 1988).

SCS's first fish auction which was open to remote bidding was in Bergen, Norway in 1992 for Norges Sildeslag (NSS) (Schelfhout, 1995). Norway has the largest fishing industry in Western Europe but the ports at which fish are landed are separated by large distances and poor roads, making transfers between ports difficult. In the old system boats radioed the details of their catch to NSS in Bergen who then faxed the details to buyers from across Norway. Buyers then had one hour to fax back tenders for the fish. The highest bids were identified and the winning bidders faxed with confirmation of the fish they had bought. The advantage of this system was in remotely selling the fish while on the boat so that the boat could then divert to land the catch at the location nearest the processor who had bought the catch. The computerised system reduced the administrative cost for NSS in running the fax auction and speeded up the auction for buyers, allowing them to adjust their bidding strategy as the lots were sequentially sold. An auction with catches from 25 vessels being marketed to 25 buyers, which previously took over three hours, could now be completed in thirty minutes. Schelfhout developed similar remote buying systems for La Rochelle and Cherbourg in France and IJmuiden, Den Helder and Urk in the Netherlands. Schelfhout learned that the variability in fish quality and the lack of reliable standards for fish description were barriers to remote fish selling, but the fish buyers subscribed to the system initially to gain access to current price information in each local market, leaving their agents in each harbour to inspect the fish and bid at the auction. They then increasingly started to buy remotely, knowing which suppliers had a good reputation (LS).

SCS's largest market for fish auctioning systems was in France: *"there they accept it and they are open to it"*(LS). According to Luc Schelfhout the difference in reactions to electronic markets is not due to structure but to attitudes: *"Some market places are not ready for it and don't want it and are afraid of it."* SCS has employed an agent in the United Kingdom for seven years but by 1996 had only sold one system to Scottish Milk. However, their main targets in the United Kingdom were the fish markets. SCS also identified Japan as a large potential market for electronic auction systems, but they have been unsuccessful in persuading Japanese markets to replace their ritualised shout auction markets: *"Japan is a country with very high technology, but go and see the fish auctions and you go back hundreds of years, it is unbelievable"* (LS).

### ***Building the Continental Market Networks***

Unlike in the North American, Australian and British markets covered in earlier chapters the pattern by which electronic markets with remote bidding have emerged on the Continent is distinctive. Whereas in the livestock markets the electronic auctions were developed in parallel to existing markets, the incremental development of technology in the Continental auctions provided a path for the progressive opening of markets to remote bidders, first by linking markets and then by allowing bidders to bid from their own

offices. These contrasting paths evolved because of the emergence of English auctions in the UK, where there is little incentive to automate the auction internally, and Dutch auctions on the Continent, where rudimentary automation could adjudicate on the first bidder. The Dutch auction mechanism suffered from disputes over which bidder bid first and at what price. Mechanical systems linking a falling clock to levers overcame this problem ninety years ago. The existence of this rudimentary technology led to the formation of firms specialising in supplying auction systems, who combined an awareness of technical aspects of the systems and the needs of auction users. Resistance from existing traders was limited because they would be at an advantage relative to remote bidders because they could inspect the stock directly. SCS only emerged as technology supplier in 1983, but Schelfhout's electronics education and background in farming enabled him to see how the technology could meet the perceived need to improve market efficiency. Whereas in the livestock systems described in earlier chapters there was a separation between technical and business aspects of each systems design, Schelfhout fits Hughes' (1988) model of a heterogeneous engineer, treating the technical and social aspects inextricably entwined. Where the IT specialists were enrolled the livestock projects with a pre-defined specification of the system's functionality, SCS are enrolled by operators of existing markets to analyse the existing market and propose solutions. This process follows the NEMI and satellite auction systems in North America, simplifying the conception phases by automating the existing market mechanisms, but the adoption phase is also simplified because the implementation is also an evolutionary change for existing market users. Similarly, the linking of markets and opening up of markets to remote bidders can have limited impacts on existing buyers in the market who will keep the advantage of being able to inspect directly the fish for sale. With the technology developed for these auctions the system suppliers could then offer their systems to market operators in the fish industry, where there was not a history of using clock auctions, but demonstrating to them their use in other sectors.

### **Highland Harbours**

Similar difficulties in gaining user agreement were encountered during the first attempt to introduce an electronic fish market into the United Kingdom. Lochinver is a fishing port on the North West coast of Scotland. Lochinver's harbour and fishmarket is owned by Highland Harbours, the section of Highland Council's Transport Services Department responsible for the management of the harbours in council ownership. Highland Harbours own the harbours at Kinlochbervie, Lochinver, Portree, Gairloch, Kyle and Uig. While Highland Harbours own the harbour and associated buildings, the selling of fish in the harbours is carried out by fishselling companies. In Lochinver, the Lochinver Fishselling Company (LFC) is the sole fishselling company, organising the daily evening fish auctions. LFC is a subsidiary of Denholm

Fishselling which operates fish selling in several Scottish ports. LFC also operate as vessel managers, with shares in twelve boats fishing out of Lochinver, and act as agents in the Lochinver fishmarket for a number of fish processors (GM).

Derek Forester, support services manager within transport services at Highland Council in Inverness, first became aware of electronic marketing in 1987/88 when Highland Harbours were planning the redevelopment of the harbour at Kinlochbervie. They looked at the harbour and market facilities at harbours across Europe, because they recognised that fish landing was becoming an international business. They were aware that fishing harbours on the continent had been using information technology to improve the efficiency of the auction. The plan was to invest £7M in creating a new harbour basin vertage and auction market at Kinlochbervie and Highland Harbours wanted to ensure it could accommodate future changes in fish selling.

In the Lochinver auction fish are landed by the boats having been sorted into boxes by size and grade. The boxes are lined up in the auction hall and the auctioneer, followed by the buyers, auctions the fish using an English auction, boat by boat. Where there are a number of boxes of the same size and grade from the same boat the auctioneer will first auction them "choice" allowing the successful bidder to select how many of the boxes they want at that price and which boxes. Other buyers may then take boxes at the same price and then the remainder are then auctioned for a lower price. Highland Harbour's survey of continental markets identified the existence of alternative selling systems to this United Kingdom "shout" system of rising bids. Forrester visited the marketing hall in Zeebrugge, which at that time was seen as being the most innovative system in Europe. There he saw the Schelfhout Moby clock, which was a battery driven lorry with a clock on it with computer connections to bidders in the old market. While in the Belgium and the Netherlands they also visited fruit and flower auctions and visited Nieaf-Smitt's fish market installation at Scheveningen which used a mobile clock travelling on a rail. These visits to continental markets led Highland to realise the advantages of a more automated bidding mechanism in their own markets. In part these were savings from being able to computerise auction administration, but benefits were also expected from opening up the auction to more competitive bidding. In the "shout" auction, in practice only two bidders are usually bidding; when one drops out the auctioneer needs to find a third bidder but this leads to a loss of momentum and the risk of a prospective bidder being overlooked and the highest price being missed. In Highland's markets the buyers are either buyers buying on their own account for resale or agents acting for remote merchants. It is common for fish sold through a Highland auction in the evening to be sold again at an English auction, such as Grimsby, the following morning by someone who believed there was a price differential between the markets.

During 1988 Highland considered using the existing electro-mechanical technology to link their markets in Kinlochbervie and Lochinver. Nieaf-Smitt provided a dummy system to demonstrate to people what the system would look like, and SCS personnel also visited to assess the existing markets. There were significant differences between the continental markets and Highland Harbours markets. In the United Kingdom fish are sold in much larger lots. In the United Kingdom the lot is not a box of fish, rather it is all the fish of a particular grade and species landed by a particular boat, which could be 300 boxes of fish. Therefore the speed and administrative advantages of automating the auction were less in the United Kingdom than in mainland Continental markets. George Mackay, the manager of LFC, the Lochinver fishselling company, was invited in 1990 by Schelfhout to see the electronic auction in Zeebrugge: *“We were quite impressed. We could see differences with Lochinver, which is a much more mixed port, whereas Zeebrugge majored on two or three species”* (G Mackay) . Mackay saw that the cost of grading the fish for remote customers was a barrier to setting up an electronic auction in Lochinver and that there would be no advantage in introducing a local clock auction for buyers present in the Lochinver auction. In 1991 Highland decided not to proceed with an automated market. They decided that the technology was not sufficiently flexible, as it was an electrical development from the traditional mechanical falling price Dutch auction. A bidding up English auction was then new to both of the suppliers. Both Schelfhout and Nieaf-Smitt were in the process of offering bidding up English auction systems, although they both argued that a falling price auction would give better prices. To accommodate these possible future changes the Kinlochbervie market was built with an auction hall in which a moving clock could be installed later and a room was included which could be used for buyers bidding using terminals.

The biggest change in Highland Harbours' operations during the nineties was a rapid increase in the landing of fish at Lochinver for onward transport to the continent. In 1996 Lochinver accounted for 80% of non-United Kingdom fish landings in Scotland, with fish landed by French, Spanish, Faeroese and German boats. From a position where the harbour was dominated by United Kingdom boats landing their catches for sale through the market, they now found a large part of fish landed was not going through the market but was being consigned to continental markets. The fish was still sorted and graded at the harbour, but the harbour was losing the commission on auctioning.

The most significant foreign landings were by French boats from Lorient, Brittany. The connection between Highland Harbours and the port of Lorient started in 1991 when Jego Quare, France's largest fishing company, approached Highland Harbours to set up a base in Lochinver for landing deep-sea fish caught on the continental slope for transport by road to Lorient. Lochinver harbour was being redeveloped and they wanted to use it as their main landing point for their nine large trawlers fishing in the North Atlantic. In 1994, following a financial crisis, Jego Quare was taken over by a predominantly

Spanish consortium, but it still operates a fleet of five large trawlers in the North Atlantic. The large French trawlers fishing the continental slope are predominantly based in three harbours: Lorient and Concarneau in Brittany and Boulogne. When landed in Lochinver the fish is sent by road for auction in the trawler's home port (DFII).

The commission Highland Harbours receive on fish landed at one of their harbours is taken as a percentage of the sale price at the first point of sale. In 1994, when Jago Quare was in financial difficulties, Highland Harbours contacted the Lorient harbour authority to ensure that they would be paid its charges on fish sold through the Lorient market. From this contact it was realised that both harbours could gain from co-operation. The fish processing industry in Lorient had to source fish from beyond Lorient. In 1996 processors based in Lorient processed 90,000 tons of fish but the total landings of fish by Lorient boats was only 30,000 tons. However, Highland operated harbours with no fish processing capacity, so Lorient saw the Highland harbours as a potential source of fish for their processors. The Lorient harbour operator suggested to Highland Harbours that deep-water fish landed in Scotland be consigned for sale and processing at Lorient, not just the fish landed in Scotland by Lorient based boats. Lorient sought to buy the fish landed in Scotland for resale through the Lorient market. As Highland's commission was based on the first sale price and they sought to increase the volumes of fish going through their markets, this offer was not attractive to Highland Harbours.

The continental boats were fishing the continental slope for deep water species, whereas the United Kingdom boats were fishing the continental shelf for more orthodox fish. When the continental boats started landing these fish there was no United Kingdom market for them so the fish had to go to the Continent, generally to the market in Lorient. Since 1994 there has been a further change, with the deep water fish targeted by the French also being targeted by Spanish and United Kingdom boats. Increasingly United Kingdom boats are being built with the capability of fishing the continental slope for non-quota species, which include blue ling, roundnose grenadier, scabbard, greater forkbeards, argentinies and redfish. In 1996 these species were still outside EU quota, but there was an expectation that due to competition for the fish stocks a TAC (Total Allowable Catch) for each species would be introduced, with national quotas based on the proportions of unregulated landings by the boats registered in each country. There was therefore a policy motivation in encouraging British registered boats to land these species by creating a United Kingdom market for them.

While there was hardly any competitive market for deep sea fish in the United Kingdom, elsewhere it had been shown that there was a demand. Principally there is a well established market for deep sea fish in France, with even deep sea fish landed by United Kingdom boats tending to be sold on to France, but also

there is a market for grenadier in Portugal, which has a history of catching them by line off Madeira. Twenty years ago Russian boats industrially fished continental slope fish in the North West Atlantic. Denholm Fishselling, through the Lochinver Fish Selling Company, had established a demand on the local market for these fish, most of which were for consumption in France and Spain, but it was reported that prices had fallen as the quantity landed had increased. In May 1996 it was reported that blue ling had fallen to £30 per box, compared to £50 in 1995 (Fishing News, 1996a).

The strategic attraction of electronic auctions to Highland Harbours was that their harbours are closest to where the fish are caught and they need to offer fishermen a good price if they land and sell their fish through the Highland markets. This requires there to be sufficient buyers in the market to guarantee boats a good price, which has not historically been the case. A single boat has landed 120 tonnes of deep water fish in one cargo, which was equal to the total sales through the market in the preceding six months. To auction that quantity of deep water fish in a day requires access to a wider market than provided by the buyers present every day in the market. For these reasons large landings of deep sea fish are consigned to continental markets. When deep sea fish are landed at Highland Harbours and sold through the market, because there are very few buyers for these fish in the market, the auction sells the fish by telephoning possible buyers and negotiating a sale, so it is not a true auction. Having a computer system would allow potential buyers from across Europe to be notified of future landings, who may then either bid or ask their sub-buyers to check the catch when it is landed. The main expected benefit of an electronic auction was overcoming the thin market which existed in Highland Harbours remote landing points, particularly for fish considered exotic to British tastes. Also, Highland Harbours smaller harbours did not have auction markets and it had been found difficult to persuade skippers landing fish at these ports to transport them to Lochinver or Kinlochbervie. Highland Harbours were initially interested in the potential of an electronic market to give boats landing at these smaller harbours access to a wider market (DFII). Highland Council feared the smaller harbours would decline because boats that landed at them would either have the cost of consigning their catches to other markets or take the lower prices offered by the buyer on the spot. The fishing industry was under stress, with quotas preventing boats landing enough to be viable and leaving the processors short of fish to meet the demands of their own customers, the large grocery supermarket chains. For Highland Harbours, being a division of local government, their formal strategic objective in promoting electronic selling was to ensure that the economic activities in the harbours were maintained and jobs not lost.

To create a viable remote auction it was recognised by Forrester that it would require the support of buyers. One approach considered was to develop electronic links with less than a dozen major buyers, but

it was feared that because they had good market information this would not lead to a competitive market. To make the market competitive it was believed to be necessary to include medium sized buyers.

Between 1994 and 1996 Highland Harbours discussed forming partnerships with several continental auctions in which their local buyers would buy electronically from Highland Harbours. In 1996 IJmuiden, Zeebrugge and Egersund announced that they were combining their electronic sales to form a consortium running a joint auction. IJmuiden and Zeebrugge proposed to auction very high quality fresh fish simultaneously in both markets. They then proposed to develop this incrementally to include further auctions.

Highland were keen to exploit their partnership with Lorient. Although the Lorient harbour market is managed by a subsidiary of *Companie General des Eaux*, like Highland Harbours, it is owned by the local authority. Lorient did not operate an electronic auction. Highland proposed that Lorient would connect to the Highland electronic auction and buyers in Lorient would remotely buy fish landed in Scotland. In the Lorient auction they charge commission on the seller and the buyer. In the proposed system Lorient would get the buyer's commission if their buyers bought a lot, but the seller's commission would be paid to Highland. To Highland the advantage of operating through the Lorient market rather than setting up the system unilaterally and allowing French buyers to connect directly was that the partnership would give the market legitimacy and ensure the enforcing of contracts locally in France

Highland Harbours knew that deep-sea fish were achieving much higher prices in France than were being made by the small quantities going through their own markets because there were few buyers for them in Scotland. Highland proposed to Lorient the setting up of a pilot electronic market which would be open to buyers anywhere because Highland Harbours were concerned that a system only open to buyers based in the Lorient market would be open to distortion through collusion between the Lorient buyers. Lorient reacted positively to this suggestion, concerned that Highland would enter into an electronic market partnership with another European fish market. Highland Harbours approached three companies who sold fish marketing systems, including Schelfhout of Belgium and Nieaf-Smitt of Holland. Of these, Schelfhout's bid was the lowest to meet Highland Harbour's specification (DFII).

There was some resistance when the concept of the electronic auction in Highland Harbours was proposed, particularly from fish trading firms. Highland claimed to them that the electronic market would provide a facility they could use and that they would still get their commission. There were also political objectors who believed that the strategy for developing the economies in the West Highlands should be to develop fish processing rather than set up mechanisms for selling wet fish for processing outwith the region. However, Highland Harbours countered this by pointing out that the existence of an electronic auction did

not preclude the buying of the fish locally and the market demand across Europe is for whole wet fish rather than prepared fillets. The potential of a competitive market in drawing increased foreign landings into their ports which would otherwise have landed at other harbours was seen as overcoming this disadvantage. It was believed that in the electronic market the local buyer would have an advantage, because they see the fish and can deal in smaller quantities.

The system was bought outright from SCS without restriction on what it could be used to auction. The system was to run on a Novell server PC network with ISDN links, with the server in Inverness, and bidding terminals in Kinlochbervie and Lochinver. One PC would do administration and the other would run the auctions. Fifteen bidders would be able to connect to the auction locally and remote buyers would connect by ISDN. ISDN operates at 64,000 b/s which, with the built in synchronisation, would overcome the problems of synchronising bids. Lorient were keen to use satellite communications, but Forester believed this was largely because their parent company was involved in satellite communications. This was seen as a very expensive option, with the installation of satellite dishes and the cost of satellite time. The Highlands has a high level of ISDN infrastructure, having had digital telephone exchanges since 1991.

Highlands and Islands Enterprise, the government sponsored economic development agency, offered to fund fifty percent of the project costs. HIE had a history of supporting the Highlands fishing industry and Highland Harbours had close links with HIE's fishery section, which had funded studies into the market potential for deep-sea fish. HIE were keen on electronic marketing as a means to keep the smaller harbours viable, with the potential of the system to develop the landing of deep-sea species in Scotland secondary. (DFII)

At this stage only Highland Harbours, Lorient and HIE were directly involved in the project. Highland Harbours had consulted some of the fishermen based in their harbours. They deliberately only spoke to fishermen independent of fish selling companies, as it was believed that employees of the vertically integrated companies which were involved in fishing, trading and processing would not be able to give a clear fishermen's view. Highland Harbours viewed the boat operators as their primary customers, not the wider fish industry. Highland Harbours also spoke to buyers based in the smaller harbours, who generally bought fish from the boats on contract and sold directly. These buyers could see an electronic market as giving them a channel for selling any surplus. Lorient spoke to buyers in their own market, while Highland spoke to "one or two" buyers based in France who were not based in Lorient. These consultations were informal, seeking to assess the general degree of interest in an electronic market pilot. No one was expected to commit themselves to using the system. At the end of this consultation Highland Harbours

were able to tell Lorient that if the prices achieved on the system were “right” fish would be offered for sale electronically (DFII).

In July 1996 the plan was to run the auction as a pilot scheme for deep water species with only one auction per week. The aim was to run the pilot system from late Autumn 1996 for 12 months. It would operate in Lochinver and Kinlochbervie, but would then be extended to Highlands’ smaller ports and then to non-Highland Harbours ports, including Mallaig, Ullapool and Scrabster, who would use it commercially. While Highland Harbours’ prime concern was their own harbours, the council also have an interest in the future of the other harbours in the Highlands run by harbour trusts. Highland were also considering auctioning mussels electronically. Mussels are sold in existing markets and Highland Council manages the harvesting of mussels in the Firth of Tain for the Tain City Common Good Fund under Royal Charter, selling 2000 tonnes of mussels each year. Highland also saw the potential for auctioning added value fish products, such as smoked fish fillets, and for auctioning live crabs, lobsters and langoustine, which are generally exported live in tanks of water to France. Shellfish are generally landed at the smaller Highland harbours by local fishermen, with the electronic market potentially giving them access to a wider market, rather than having to accept a price from a single local buyer.

Forester believed that selling their fish electronically at Lochinver would be less costly for the French boats than consigning their fish to the market in Lorient. For fish landed at Lochinver Highland charged 2% plus a further 2.5% if they were sold through the market. To sell the fish in the Lochinver market LFC charged 1.75%. The proposal was for the electronic auction to charge the same selling commission, 2.5%. In Europe the pattern is for a single fee to be paid in harbours. Forester believed that the lowest commission in France was 4½% and the highest 10%. In the port of Lorient the combined seller and buyer commission is 6.25%. For a boat landing fish and selling them through the proposed electronic market the total commission would be 6.75% (the fishselling fee of 1.75%, plus the landing fee of 2%, plus the market fee of 2%). This appears to be 0.5% higher than the fee to sell the fish through the Lorient market, but the true Lorient total commissions would be 8.25% because they would still have to pay Highland for landing the fish in Scotland. Forester was unsure whether Lorient had realised that the proposed fee structure gave an advantage to French boats auctioning their catches through the Highland auction with the buyers connecting in France: *“I hope they have not worked out the figures”* (DF). Further, he argued that the fee difference would be even greater if the French boat sold their fish on the system without using the fishselling company: *“that might be a threat to their business, it is not something we are pushing, but it might happen”* (DF).

The plan for the pilot electronic auction was featured in an article by McCaffrey (1996) in Fishing News on 31<sup>st</sup> May 1996. This article was the first that many in the fishing industry knew of the proposed system. The article stressed the remote bidding capability and its use to give a wider market for deep-water species. McCaffrey acknowledged that traders had resisted computerisation due to fears of losing jobs, but he argued that on the continent these job losses had not happened due to the need to employ extra people to verify the quality of the fish sold. The same issue of Fishing News included an editorial suggesting that the pilot electronic auction would be "*part of something bigger, and probably inevitable: the computerisation of industry*", but arguing that this would lead to rationalisation and "*Europeanisation*" of auctions. These articles triggered a negative response from across the United Kingdom fish industry, with merchants fearing that they would be displaced by electronic auctions. Forrester had a letter published in Fishing News attempting to allay their fears, reassuring existing users of Lochinver and Kinlochbervie that the system would not jeopardise their market and that use of the system would be voluntary (Forrester, 1996). Of the six buyers seen operating in the Lochinver fish market, three were employees of Denholm and two were strongly anti electronic selling. The final buyer was less antagonistic, saying that he and his customers realised that an electronic market might give them access to fish which were not passing through the market. In particular he criticised LFS, who through Euroscot and their direct selling, were forestalling fish from appearing in their own market. He believed that in the electronic market the buyer who was at the auction and able to visually inspect the fish would have an advantage over remote buyers buying on description.

The proposed establishment of an electronic system in Lochinver and Kinlochbervie also threatened the fish selling companies in the two ports, because boats might sell their catches directly on the electronic system bypassing the salesman. Forrester claimed that their fears were misplaced because they do more for their fee than sell the fish in the auction: they also represent the boats, but get paid through a sales commission. George Mackay, manager of Lochinver Fishselling, first learnt of Highland Harbours plans when he read about them in Fishing News. Lochinver Fishselling and JW Holdings, their equivalent fishselling company in Kinlochbervie, demanded a meeting with Highland Harbours: "*We were annoyed that the region were promoting this in the press as if it was a **fait accompli**. We were getting accused by the buyers and their customers of pushing this*" (G Mackay). At the first meeting attended by the managing directors of LFS and JW Holdings, Highland Region promised that the fishselling companies would be consulted. Six months later there was a further report in the fishing press saying that Highland were going to introduce the electronic system in Lochinver and Kinlochbervie from March 1997. LFC and JW Holdings' fish processor company customers in the east of Scotland threatened to boycott the markets. LFC and JW Holdings sent Highland a four page lists of points to be addressed and a meeting was

arranged. Another meeting was held in Aberdeen, described by Mackay as “quite heated”. Highland promised that there would be a feasibility study, but in July 1997 Mackay had not heard of any progress (GM).

George Mackay believed that Highland had not thought through how the electronic auction would operate: “We couldn’t understand who was going to do what. They shrugged their shoulders and said it was just a pilot study. We asked ‘Who is going to organise the grading and the quality control?’ and they said ‘We thought the fishselling companies would do that’, but we hadn’t been asked” (G Mackay).

LFC’s relationship with Highland Harbours was described by Mackay as “not too good”. In the past LFC would supply boats landing at the harbour with fuel and ice. In 1987, shortly after Denholm took over LFC, Highland refused to renew LFC’s lease on the oil tanks, saying that they were going to take over the fuel supply business. LFC wanted them to take over the ice plant, as LFC did not see the ice business being profitable without the oil business, but Highland refused. They have been suspicious of Highland’s objectives since, so when Highland admitted they were planning an electronic auction it was suspected that Highland wanted to take over the actual auctioning of the fish.

JW Holdings are more vehemently opposed to electronic auctioning than LFC because most of their fish is sold to United Kingdom processors, whereas the majority of fish landed at Lochinver is destined for France and Spain. George Mackay could see advantages in selling electronically to overseas buyers, based on their involvement in the direct consignment of fish to French markets. LFC have a partnership, Euroscot Ltd, with a French Fish trader, Phillippe Formale, who first came to Lochinver to set up the base station to support the French boats, but left Jago Quare to market fish, mainly in Brittany. Euroscot buy fish, predominantly directly from the boats, grade it to French market standards and pack it in French boxes and ship it direct to French markets (GM).

In the existing auction fish are graded by size and quality on the boats and boxed in ice. George Mackay was concerned whether an electronic auction could raise prices sufficiently to cover the additional commission which would be necessary to pay for the independent grading of the fish. For some boats, LFC sell fish on the description of the crew. Larger boats will fax LFC with details of their catch and LFC will sell it to the processors by telephone, charging the same commission as they would for sale through the auction. However, the buyers are basing their prices on their knowledge of the reputation of the boat, and the relationships are not purely market-based, with buyers buying fish from boats when there is an oversupply in return for the expectation that the boat will supply them in times of shortage (GM). In an open electronic market the problems of guaranteeing the descriptions would be much greater.

The need for someone to assess the fish and someone to pay for the assessment became a major barrier to the introduction of the electronic auction. To sell fish electronically to remote buyers they would require an assessment of the fishes' size and quality. The European system for fish grading are specified in regulation 100/76, article 2-4, with detailed provisions in regulation 103/76. These specify that fish must be sorted into homogenous lots of three freshness categories (E, A and B) and into either 3, 4 or 5 size categories, depending upon species. Freshness is assessed using appearance and smell. The responsibility for grading falls on the industry, with it usually being undertaken by employees or agents of the local producers association. Fisheries inspectors supervise the operation of the grading scheme but do not themselves grade fish (Howgate, 1983). Torry Research Centre (1995) developed a more discriminating sensory scale for assessing fish freshness based on a scale from 0 to 10. Compared to livestock carcasses, the quality grading of fish is an imprecise exercise. E is "excellent", which corresponds to fish caught on the day sold and which has been carefully handled with bright eyes: "*it smiles at you*" (GM). Grade A covers the majority of the fish landed, covering fish caught in the past week. Grade B fish are at the point of smelling, but still just fit for human consumption. In the United Kingdom, the Sea Fish Industry Authority is involved in developing more discriminating standards, but an electronic system linking Highland Harbours and Lorient would require a standard recognised and accepted by buyers in both countries. The development of a reliable and discriminating system for the European fish industry is the aim of an pan-European project funded by the European Commission, CRAFT. In United Kingdom harbours, fish is first graded by the skipper who is landing it, who completes a tally of his landings with grades and sizes. This record is checked by the auctioneer, who may reject the skipper's assessment and substitute his own. In the Highland electronic auction the aim was that the fish would be landed, weighed, sorted by EU grades for size for the species and graded. (Currently United Kingdom catches are not necessarily weighed, but measured in boxes of a nominal 54 kg, which may be overfilled to avoid quota. Forester's expectation was that all the fish sold electronically on the planned Highland system would be A grade. If any was B grade it would be boxed separately and sold as such. If fish was to be sold on the electronic auction on the skipper's assessment and estimated weights the bidders would be notified of this, but Forester suspected that the lower prices they would get from the uncertainty in this would tend to lead to this dying out.

There was a hiatus in the project to set up the electronic auction in mid 1996 because one of the two Highlands Harbours staff involved was taken ill for six months. Highland Harbours did not have a surfeit of people to draw on, with the management of Highland Harbours only representing 10% of Forester's responsibilities. SCS continued developing the system, but the organising of the electronic market fell behind schedule (DFII). It was planned that a delegation from Lorient would visit Inverness in summer

1996 to agree how the market would be used. This visit did not take place until February 1997. This visit included a formal meeting to identify activities to be undertaken by the two sides. A key issue identified was to agree a system for describing the quality of fish sold electronically. A joint working party was set up to resolve this by June 1997 including people from both sides (DFII).

The Lorient franchise holder comprises the town council, the Brittany regional government and their district council (holding 70% of shares), with the remainder held by two merchant banks and the harbour operator, a subsidiary of Generale des Eau. Highland Harbours negotiated with the harbour operator on behalf of the franchise holder. The French delegation returned to Brittany and Highland planned their activities for the four months up to system implementation, including informing harbour and fish market users of the pilot system and *"truthfully selling it to the industry and letting the various parties know that this isn't something to cut them out, it is not to do anyone down"* (D F). The Lorient harbour authority released a statement to their local papers which was picked up by United Kingdom traders selling fish into France. Forrester was telephoned by East of Scotland based processors and merchants threatening to boycott Highland Harbour's markets because they feared it would take fish away from them: *"The question was put by a trader - 'Why are you doing it?' To which the answer was fairly simple - to increase the price obtained at first point of sale, and we hope, as harbour operators, to make our harbours more attractive and bring more volume in. At which point the party we were speaking to said 'Huh, right, hmm...' and hung up"* (DFII). Processors objected to the electronic system because they feared that it would increase the proportion of fish leaving Scotland for processing in France. Forrester explained to them that they would now be able to buy and process fish that currently was going to France unprocessed. Forrester recognised that traders who bought at the harbour to make a profit by reselling in another market would feel threatened. To minimise this resistance the pilot was restricted to deep-sea fish, 98% of which was never being made available for local buyers. He stressed that in the electronic market local traders would have the chance to bid for this fish. (DFII)

Highland Harbours planned in March 1997 to have ongoing meetings with merchants and processors to keep them informed and boat operators to persuade them to land fish at Highland Harbours and offer the fish for sale on the system. Highland Harbours' longer term plan was to use the system to attract fish currently being landed at Scrabster, a trust operated harbour in Caithness on the North coast of Scotland, Killybeg, Ireland's largest fishing harbour, and Milford Haven in Wales, by offering a port nearer the fishing grounds at which a good market price can be obtained (DFII). Tentatively they saw the operation of the system as placing them at the centre of a network of harbours. However, on the Continent the same pressures were leading other fish markets to co-operate into networks.

Lorient's neighbouring port of Concarneau introduced an electronic market in 1996, which made Lorient investigate the use of electronic auction for selling fish landed at Lorient. La Rochelle, another French fishing harbour, entered into a collaboration with Zeebrugge in Belgium, in which Zeebrugge's 150 buyers would bid remotely for fish landed at La Rochelle. Zeebrugge also collaborated with Milford Haven and is linked to IJmuiden in the Netherlands, which itself is linked to Den Helder in Northern Netherlands and Urk on the IJsselmeer and Egersund in Norway. This emerging network is missing harbours in Scotland and Brittany - Zeebrugge had approached Highland Harbours and Scrabster<sup>38</sup> to explore participation in this network of auctions. Zeebrugge, like Lorient, is a harbour short of fish. The market is owned by a private company which has invested £15M in a new market with associated fish processing facilities. Zeebrugge only lands 15,000 tons of fish per year. Up to 1995 Zeebrugge were, again like Lorient, trying to get fish landed elsewhere consigned for sale and processing in their market, but their strategy changed to one of developing alliances with other harbours to gain access to fish for its local buyers. Forrester recognised that if the pilot electronic market was a success they would want to join a wider European network of fish auctions (DFII).

In early 1997 the system had been developed by SCS. The system hardware comprises a personal computer displaying the auction clock to bidders on a number of screens. Three bidders were to share a screen, each provided with a bidding button. The auction could be in either English or Dutch. For remote buyers the price is displayed in their local currency based on that morning's exchange rate. However, the system stayed in its boxes until the resistance of market users could be overcome and the procedures for operating the auction agreed.

In Spring 1997 Highland Council had retreated from installing the system in Lochinver and Kinlochbervie and planned to operate the pilot system in two smaller harbours, Kyle and Gairloch, for a year. The timetable for extending it to the other harbours was flexible due to the need to avoid a boycott by merchants. To be successful for deep-water species it would have to be implemented at Lochinver, the harbour at which most of these fish are landed. Initially it was planned to auction one lorry load of fish per week (DFII). The aim was to start selling creel caught live prawns, as opposed to the lower quality trawled prawns landed at East coast harbours, landed at the two smaller harbours with remote buyers from Zeebrugge. These would be transported live to the continent using the newly inaugurated daily flights between Inverness and Schiphol, Amsterdam (DF III).

The owners of the Zeebrugge market visited Lochinver several times, speaking to Highland Harbours and LFC, arguing initially that Zeebrugge is located centrally near to the major European fish consuming areas,

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<sup>38</sup> Telephone interview with harbourmaster.

and that fish landed at Lochinver could be consigned for sale in Zeebrugge. Mackay was sceptical, believing that Zeebrugge was too close to the successful market in Boulogne to generate the volumes of trade sought by its owners. He was however impressed by the automated fish sorter at Zeebrugge, which cost over £1 million, which sorts fish by species and size (GM). Zeebrugge are now seeking to enrol Highland in their pan-European network of fish auctions which will be discussed later.

### ***Network Building in Highland Fish Markets***

The project to introduce an electronic market in Scotland exemplifies the difficulties of trying to implement a technology which requires a high degree of trust between those involved within a community in which there is initially a low level of trust. For Highland Harbours an electronic market was seen partly as a commercial exercise, partly as an economic development project and partly because it interested the instigator. The systems in use on the continent, particularly in the vegetable and flower markets, demonstrated to them the technical feasibility of a fish market in which bidders bidded remotely. A remote electronic auction was seen by Highland Harbours as a means of gaining extra revenue from landings of continental slope fish which were being landed and being consigned for sale in French markets, by-passing the Scottish markets. Forester developed a vision of using an electronic market to auction fish to French customers. Highland needed to enrol Lorient in a partnership to ensure boats would use the system and that French buyers would use it to buy fish. For Lorient the attraction of the electronic market was to draw more fish for processing in Lorient. Lorient and Highland were able to approach boat owners who would be willing to place their fish on this system and Lorient were able to enrol the French fish processors. The most difficult stage in building the electronic market was in enrolling the support of the buyers and agents active in the Highland fish markets. They were suspicious that the system would lead to fish not being available to local buyers, or would lead to fish becoming more expensive in the local market. These fears were aggravated by their non-involvement in the conception. Those agents who arbitrated by buying fish in the local markets for sale in the French markets were naturally unwilling to see the introduction of a system which would make them redundant. Highland deliberately did not consult LFC as they sought to build an electronic market. However, Highland's plan would either involve LFC running the sales on the system or be excluded. Unsurprisingly LFC interpreted the lack of consultation negatively when they learnt of the proposed system. Similarly Scottish buyers, who would be expected to use the system, were not consulted, leaving them suspicious about Highland's motives. In parallel with Highland's attempt to set up an electronic market, Zeebrugge sought to enrol LFC into their own network of fish auctions. The proposed electronic market threatened buyers in the Lochinver market, but their perception of this threat was accentuated by the lack of consultation. The buyers were able to enrol their customers, the major

Scottish fish processors, who had concerns about the effect of the electronic auction on the price and availability of fish, who threatened to boycott Highland Harbours. If they had put this policy into effect a large proportion of the boats landing fish for Scottish processors would have diverted to Scrabster, Ullapool or Mallaig. Forrester was surprised by the ability of the fish merchants to redefine the objections to the electronic market as being related to the internationalisation of a market which had traditionally been insulated from international pressures. The threats to boycott Highland harbours made by agents, processors and merchants halted progress in getting the systems off the ground. Highland sought to bypass this opposition by introducing the system in their smaller harbours which lacked the organised markets to provide organised resistance. In the background Zeebrugge maintained contacts with Highland Harbours and LFC, seeking to enrol the Scottish harbours into their network of linked fish markets which will be discussed later in this chapter.

The failure of the Highland project may be seen as a failure to enrol potential users at the conception phase which limited their involvement in specifying its functionality, but more significantly created a barrier to their enrolment during the adoption phase.

### **Iceland**

With annual production of 1,576,000 tonnes, Iceland's fishing industry is twice the size of Britain's and only slightly smaller than Norway's. However, despite the economic importance of fish to the Icelandic economy, it is only in the last ten years that fish auctions have been established. The lack of fish auctions in Iceland was noted by Cassady (1967, p 20), who saw it as an inexplicable anomaly, but suggested that it was because the fish landed in Iceland was almost wholly for canning and freezing, for which the processors would know the stable market price. However, it was suggested by the operator of one of the markets that it was more due to the number of harbours and difficulty for buyers of moving themselves or the fish between harbours. In Iceland fish are landed at a large number of small harbours around the coast and were purchased directly from the boats by merchants and processors. The poor road network outwith the Reykjavik area made the transfer of fish between harbours difficult, with fish dried at the point of landing, so there were few buyers at each harbour. The first fish markets in Iceland were established in 1987 in Reykjavik, nearby in Hafnarfjodur and 50 kilometres away at Sudernes. These markets were formed by consortia of entrepreneurs, companies in the fish industry and local government who could see the commercial potential of opening trade in local harbours to wider customers. From these three companies operating markets two competing electronic systems have developed to link markets, which have spread to almost all the Icelandic fishing harbours.

## *Tengill*

In 1987 FMS (Fishmarket of Sudernes) opened the first Icelandic fish markets in three towns in the Sudernes area of the Reykanes peninsula: Njarvik, Grindavik and Sanderöi. The supporters of FMS did not want to see fish trading concentrated in only one of these three locations. An electronic market to connect the three markets would avoid processors having to have buyers in each harbour. They commissioned a software company to develop a system, Tengill<sup>39</sup>, to link their markets. FMS then allowed other fish markets to use the system. The system was first used in January 1992 linking five markets. The success of the system in generating higher prices for sellers led increasingly to boats based at outlying harbours landing their catches at harbours operating the electronic system, so that they would be offered to the 80% of buyers based in the Reykjavik/Sudernes area. The fish processors based in outlying areas were seeing less fish and therefore wanted to see the establishment of fish markets at their local harbours connected to the fish markets in Sudernes and Reykjavik. (I O G)

A company, RSF (Reiknistofa Fishmarkada hf), was formed by the three initial market owners to operate the electronic marketing system. Eighty five per cent of RSF is owned by FMS. Total commissions to sell through FMS's markets are 4%, of which 3.35% goes to the market company and 0.65% to RSF for the market service. The Tengill system runs on an Hewlett-Packard 9000 D-250 UNIX computer using the Icelandic X.25 data network to connect to local auctions. Each local auction has a personal computer, modem and printer. Tengill does not use the falling clock system. Instead it has an auctioneer based at RSF linked to each of the local auctions through teleconferencing who conducts the auction. Prior to the auction all the buyers at each market pick up a print-out describing the lots for sale in terms of species, weight, size, time since catching, catching method, location and whether gutted. In Iceland there is currently no unified standard for fish descriptions. The eight markets in the Tengill network all use the same descriptions, based on grading each species into six size categories (I O G). On the Tengill system fish may be auctioned prior to landing, based on a description by the boat's skipper. The system was designed to provide market reports and statistics, which can be produced covering specific buyers, sellers, harbours or fish auctions. The auction follows the English method of bidding, with the central auctioneer progressively raising the price, with buyers at each auction able to hear him over a public address system. At each local auction bidders who still wish to remain bidding raise paddles displaying their number and the operator at each local auction has a button which he presses if there is still someone at their location bidding. The auctioneer can see on their computer which locations still have active bidders. When there is only one bidder left holding up their paddle, the system can identify the location of the successful bidder

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<sup>39</sup> Tengill is Icelandic for "network" - "*an Icelandic word for an object/device which links other objects together*" I O Gudjonsson

and the price they offered, but he does not know the specific identity of the bidder. The auctioneer then contacts the local operator who gives him the number of the successful bidder which is then entered into the system. The credit limits of buyers are monitored centrally, which is a major administrative saving for individual markets. In the Tengill system there is a tendency for local buyers to buy fish landed in their local harbour but, because a large proportion of fish is auctioned before it is landed, this is mainly due to the lower transport charges. At Sudernes 50% of fish is auctioned prior to landing, having been sorted on the boat. (I O G) In winter 50% of the fish is landed ungutted from fisheries close to the shore, removing the uncertainty for buyers of the quality of the gutting. In summer the deterioration in ungutted fish due to higher temperatures makes this less practicable and the fish is gutted on the boat. (I T J)

The Icelandic Tengill system has been in use since January 2 1992 linking between 6 and eleven fish auctions. The system serves 300 buyers and 1000 sellers. Annual sales in 1996 amounted to approximately 51,000 tons, worth \$58 M.

**Table 13: Volumes traded on TENGILL in Iceland.**

Year	Total Sales (tons)
1992	36,952
1993	41,176
1994	41,955
1995	46,474
1996	51,373

The market share of fish landed in Iceland sold through the Tengill system is relatively stable, with the increase in traded volumes due to the decrease in the proportion of Icelandic fish landed into European ports, down from 40% to 10% between 1992 and 1996.

### ***BODI***

The competing BODI system in Iceland was developed by two other fish markets. Fishmarkets were opened in Reykjavik and Hafnafjordur in 1987 using a traditional floor auction in which an English auction mechanism was used with the auctioneer calling out rising prices and buyers holding up cards while they were bidding until there was only one card left, held up by the successful bidder. In 1991 the

fishmarket operators, Faxmarkadur in Reykjavik and Fishmarkadur in Hafnarfjordur, negotiated with RSF to take a 50% stake in RSF for 10MKr (~ £1M). According to Olafur Johannsson, RSF general manager, RSF had invested 35MKr in Tengill's development, so RSF did not believe the amount was sufficient. Faxmarkadur and Fishmarkadur claimed that a system could be developed for 20MKr. Later in 1991 the fishmarkets Faxmarkadur in Reykjavik, Fishmarkadur in Hafnarfjordur and Fishmarkadur in Breidafjarda contracted for Schelfhout of Belgium to carry out a feasibility study for implementing a remote electronic fish auction. SCS was represented in Iceland by Gylffi Adalsteinsson, an Icelandic fishing industry consultant. The objectives of the proposed system were: connect many fish auction markets, combine the bank guarantees for buyers buying in several markets and have a centralised system of debt collection (Sverrisson, 1993). The proposal was to develop a system mirroring Tengill's linking of dispersed markets but replacing Tengill's use of bidders holding up paddles with an auction clock and button bidding. Instead of having Schelfhout supply the system, Faxmarkadur and Fishmarkadur set up a company, Islandmarkadur HF (Fish Market of Iceland), and decided to have a remote bidding clock auction system developed by Icelandic contractors. In 1991 Islandmarkadur contracted with Fang Ltd to develop the BODI system, with Plusplus Ltd, a firm in which Adalsteinsson had an interest, and Bjorgvin Gudmundsson as sub-contractors (Sverrisson, 1993). The development of BODI took one year and the system became operational in 1994. Islandmarkadur carries out administration of the transactions but the independent auctions compete for fish. Buyers require only one bank guarantee to bid in all the connected auctions. Each auction market has a computer to run their auctions, computers for bidding and a button computer for each participating bidder. The auction computers of the network are connected through a wide area network (WAN), which can be X.25, the PTT's network or leased lines, using either TCP/IP or UDP/IP protocols. The auction computers are UNIX computers which hold a relational database of lots for sale which can be queried from anywhere on the network. The central office invoices customers at the end of each weekly period, with the local computers holding details not just of fish sales but also oil and ice sales through the markets. The bidding computers are personal computers connected to the local auction computer through a local area network. This computer shows on its screen the bidding clock and the auction is by Dutch auction. Buyers bid using micro-computers attached directly to the bidding computer. The system is able to catch the identity of the first bidder to bid and the price on the clock at that time. Buyers have an electronic key which is inserted in the button computer so they do not have to always use the same computer (Hallgrimsson, 1994). While the number of auctions linked in the BODI system is fewer than in the Tengill system, the volume of fish traded on the system is higher because it includes the two largest Icelandic fish markets. Between January and August 1997 ISM marketed 48,564 tonnes of fish compared to RSF's 38,324.

### ***Failed Merger of Tengill and BODI***

It appears anomalous that a country the size of Iceland should support two essentially similar electronic fish market systems, both developed in Iceland based on linking bidding across a network of fish auctions. In March 1997 negotiations took place to merge the two systems. In comparing the two systems Hallgrímsson of ISM saw their system as being more sophisticated while for Johannsson of RSF this sophistication led to unreliability and very inflexible procedures for entering data. Any merger of the systems would have come down to a choice between the manual bidding of Tengill and the button bidding on BODI. An independent telephone survey was commissioned by the two system operators to identify the preferences of buyers. Of these buyers, 72% preferred Tengill, mostly because they could listen to the voice and read their notes, whereas with the clock system they had to concentrate on watching the clock. A further barrier to merging the systems was the selling of a modified version of the Tengill system to a market operator in New Bedford, Massachusetts, which would have placed a requirement on the merged company to provide technical support to the American system.

### ***CASS in Massachusetts***

RSF bid to supply a fish market system to Portland, Maine, but the contract went to a local company. RSF took part in the Boston Seafood Show in 1995 and 1996, leading in 1996 to the opportunity to supply a fish auctioning system in New Bedford, Massachusetts, instigated by the Massachusetts Seaport Advisory Council. RSF renamed the system CASS for marketing outwith Iceland. The implementation of an electronic remote fish auction in Massachusetts was announced in August 1996 (Stewardson, 1996), with the State of Massachusetts funding the system to improve the marketing of seafood. The auction was initially to automate the New Bedford auction and then it was intended to link to the auction in Gloucester. The \$300,000 of state funds would pay for a system to be implemented in 1997 and the development of a "reliable system of grading so buyers would know the quality of fish they are bidding on." This public funded system was pre-empted by two fish processors setting up a company BASE (Buyers and Sellers Exchange) to operate an electronic fish auction in New Bedford. BASE licensed the CASS system from RSF, adapted to suit their needs. The first electronic auction was held on the Massachusetts CASS system on February 10 1997. In the CASS system sold to Massachusetts teleconferencing is not used, with buyers only interacting with the system through computer terminals, thus avoiding the need for both data and voice connections. CASS is a real-time remote auctioning system in which the buyers link directly into the auction computer by phone lines, allowing buyers to bid from computers in their offices. Bidders see the price for the lot increasing on their computer screen and press '1' to enter the bidding and '0' to leave. The winning bidder is the last person in as the price rises. The United States system was developed by RSF, but the program code was extensively rewritten, especially the auction mechanism. (I O G) Buyers are able to

access the United States CASS system via dial-up modems to look at information on their previous purchases and credit balance. The system keeps track of sales orders (issued to sellers) and purchase orders (issued to buyers). CASS has a built-in accounting module and the system keeps track of each buyer's credit limit, adjusting it when a purchase is made or when payments are received.

### ***Building the Icelandic Fish Market Networks***

While the embeddedness of existing social relationships was a barrier to the enrolling of actors into the Highland system's network, the development of the two Icelandic systems was facilitated because organised fish markets were a recent innovation. Using electronic auctions to link markets was a means of ensuring a competitive market in dispersed ports while the buyers were concentrated in the Reykjavik region. For sellers enrolment in the auction systems gave access to a competitive market in their home port, whereas for buyers it removed the need to have agents in each port. While the Tengill system is an idiosyncratic system linking manual auction, the BODI system was an emulation of an SCS system<sup>40</sup>. Once two separate networks had formed and both sides could see advantages in a single national system the embeddedness of the social networks and their incompatibility became barriers to their merger.

### **Pan-European Fish Markets**

The introduction of electronic markets for local buyers in continental fish markets may be seen, as was the case in Continental fruit and vegetable markets, as an incremental evolution towards the linking and the emergence of remote buying. It is unsurprising that this process has been extrapolated to create a vision of a pan-European fish market, in which fish are auctioned to buyers from across Europe. In 1997 two alternatives projects appeared aiming to build a market allowing buyers from across Europe to buy fish landed at ports elsewhere in Europe. These two projects started out with distinct approaches, but as they developed there solutions converged.

### ***INFOMAR***

The first project, INFOMAR, was supported by Directorate General III of the European Commission to use IT to integrate the European fish industry. The project was initiated by an Icelander, Gylfi Adalsteinsson<sup>41</sup>, and Rob Gallagher, of Navigs, France. Adalsteinsson produced a presentation of a vision of the European fish industry, which Holmes says was derived from a presentation by Arthur Anderson Consulting in Spain in the early 1990s. Adalsteinsson sought funding from the European Commission to

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<sup>40</sup> The extent of this emulation only became apparent when Luc Schelfhout saw the BODI system in operation during a visit to Iceland.

<sup>41</sup> This is the same Adalsteinsson who acted as a consultant in Iceland for SCS then was involved in the development of the similar BODI system.

support this project. European Commission Esprit support was conditional on applying as a consortium of partners. Adalsteinnsson contacted Vega, a systems and telecommunications specialist, based in Welwyn Garden City to undertake the technical elements, and Havinfo of Tromso, a small Norwegian company, to take responsibility for developing the satellite links to vessels. The INFOMAR project was budgeted to cost over £3 million, with part-funding from Esprit. The project had two elements. First, a Trade Information and Forecast Service, providing data and forecasts on fish prices, weather, quota status and other industry data and forecasts. Second, a Fish Exchange Trading System *“a value-added module to the network where buyers and sellers can match their needs, agree on prices and define handling, processing and transport routes<sup>42</sup>.”* It was expected that the service, once developed, would be operated by existing markets as franchisees. The project started in May 1996 with Susan Holmes of VEGA as project manager. *“It was fairly rapidly apparent that the original business concept was unworkable” (S. Holmes).* The business case for the redesign of the industry was based largely on the structure of the Icelandic industry. The aim was to bypass the existing market infrastructure and connect buyers and sellers directly, but it was found by Holmes during preliminary discussions with people in the English fish industry to be difficult to do this as the markets’ functions were wider than simply auctioning the fish, including credit clearance, payment of crew wages, landing and packing. If a system could be developed it was unclear who would operate it and ensure these roles were carried out. The project was restructured towards including existing market operators rather than trying to bypass them. In July 1996 Holmes met Bryan Renn, the United Kingdom representative of SCS, and Luc Schelfhout in September, seeking a partner with experience in supplying electronic market systems. She also met a representative of SCS’s competitor, Nieaf-Smitt. She negotiated for Schelfhout to join the consortium. It was at a meeting at this stage in Iceland that Luc Schelfhout realised that the BODI system was a precise copy of a Schelfhout system. Adalsteinnsson left the consortium and was replaced by Schelfhout. The project became more focused towards the markets, and in particular, as a pilot, the Dutch market in IJmuiden. In a press release published to announce Schelfhout’s joining of the consortium, INFOMAR aimed to: *“link first-hand fish traders through a wide-area data network which is extended to fishing vessels at sea via satellite communication systems. Buyers and sellers pass information to each other using an extranet (an intranet solution used for electronic trading). Centres in each country, usually sited at the local auctions, administer a database containing up-to-date catch information from fishing vessels and current auction prices and demand. They co-ordinate the transmission of information and provide a gateway to facilitate the efficient trading of fish between buyers and sellers around Europe, both on land and at sea”.* According to Holmes, Rob Gallagher of Navigs has a large involvement in the technology on the vessels, Schelfhout are driving the business concept, and

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<sup>42</sup> CEC GDIII Project Summary for Infomar (22201)

VEGA are responsible for the land-based development and project management. Schelfhout discusses the details of the systems with the auctions. *"I don't think a vision of what the project involves has ever been agreed by all the participants - they have widely differing commercial aims and backgrounds, and the project has changed so much since it started that there are always tensions"* (S Holmes). It is planned that the service will be commercially launched in May 1998, but the form of the service is unclear.

### ***Pan-European Fish Auction (PEFA)***

While INFOMAR evolved to a less ambitious vision of the use of IT in the fish industry, Zeebrugge was developing a plan to link European fish markets into a network. In Summer 1997 Milford Haven Fish Auction, Zeebrugge and La Rochelle linked their three markets using ISDN lines, allowing buyers in each market to bid for fish landed in each other market. Milford Haven is 99% owned by Zeebrugge and each of the auctions in the network uses an SCS auction system. It was planned that the network would then be extended to IJmuiden and Den Helder in the Netherlands, and discussions were ongoing with a number of other markets including Plymouth and "one in Scotland". On June 19<sup>th</sup> 1997 boxes of ray and plaice landed at Milford Haven were bought by a buyer in Belgium (Fishing News, 1997b). The system was innovative because it allowed two-way international buying and selling of fish. The network planned to use the Torry Count fish standards system, rather than the REVO Dutch system used in IJmuiden and Den Helder (MJ).

In Summer 1997 Zeebrugge reassessed their policy of using ISDN lines to link the markets, finding the cost of international ISDN lines excessive. They decided to develop an alternative electronic fish market based on a world-wide web (WWW) site. The site is planned to have various levels of access, from passive observers to active bidders who have credit clearance to buy. The system has been named Pan-European Fish Auction (PEFA). The project is being managed from Milford Haven, with AT&T managing the Web site. The site is planned to be in operation in February 1998 linking ten fish auctions across Europe. According to Jay, the Zeebrugge strategy is still to use the system to build incrementally a network of linked auctions. PEFA and INFOMAR may therefore be seen as very different routes to achieve the same end: a pan-European fish market with remote bidding. Jay was particularly critical of the decision in INFOMAR to integrate the advertising of the fish caught, which he saw as open to misrepresentation and primarily the role of the boats' agents<sup>43</sup>. He saw the INFOMAR project as remote from the needs of the industry, driven by the interests of communications and computer specialists.

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<sup>43</sup> When observing the fish auctions in Lochinver and Grimsby systematic under-reporting of fish was seen. Boats landing at Lochinver would fax Denholm with details of their catch, but this often underestimated what was landed. Similarly in Grimsby, fish consigned by ferry from Iceland arrived in a much larger

### ***Building the Pan-European Markets***

At the time that they were studied both PEFA and INFOMAR were still in their conception phases. INFOMAR's instigation came from Adalsteinsson in Iceland, who, drawing on concepts seen elsewhere and the example of the Icelandic auction systems, built a network to obtain EU funding for creating a pan-European network. To achieve this a network of technology and industry specialists was built and an electronic market problematised as a mechanism for creating single European market in fish. In contrast, PEFA's instigation in Zeebrugge was more limited in scope and evolutionary rather than radical, involving the progressive enrolment of the operators of fish markets across Europe into the network. The conception phase of Infomar followed two patterns seen in the livestock systems seen earlier in two ways. First there was a realisation early in the conception phase that to enrol a network of boats and buyers would be easier to achieve by enrolling the operators of existing fish markets rather than setting up in opposition to them. Second, while a system of trading on description and trust had been seen to work in Iceland, where business relationships would be embedded in a tight social network, this would be difficult to achieve in a pan-European network with trading between distant partners in transient trading. These two realisations led to the redefinition of the project, with Adalsteinsson departing and SCS joining the network which switched to a strategy of developing a system for use by existing markets. SCS were enrolled partly because of their technical expertise in auction systems but also to enrol indirectly their user-base of fish auction operators. Therefore again we see a pattern in which enrolment combines the translation of technical resources combined with the translation stabilised actor networks through the enrolment of pivotal members of existing networks.

### ***Building the Fish Market Networks***

As with livestock markets, the pattern observed in fish markets is for electronic markets to develop around existing markets, but as in Continental vegetable markets, the pattern has also been for electronic markets to evolve from existing physical markets. This provided a route for the market for fish auction systems to be dominated by SCS and Nieaf-Smitt, the leading suppliers of systems to fruit, vegetable and flower markets. The opening up of electronic markets to remote bidding was due to two complementary pressures. First, in small markets remote bidding allowed the linking of markets to create a more competitive market, as seen in both the Icelandic systems and in NSS in Norway. Second, for markets in harbours where processors were short of fish remote electronic markets were seen as a means of gaining access to more fish, as seen in Zeebrugge and Lorient. The success of the Icelandic systems in relation to the abortive attempts to establish an electronic auction in the United Kingdom can be attributed to two factors. First,

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quantity than expected. It appears that sellers underestimate their catch when they are advertising it to prevent their announcement pushing prices down.

the short history of fish markets in Iceland reduced the embeddedness of the social structures on which the systems were overlaid; essentially the developers had only to deal with sellers and buyers, not the complex structure agents and merchants seen in the United Kingdom. Second, the Icelandic fishing industry is a more culturally homogenous community than in the United Kingdom, where it is diverse with fish being brought into the market from a wide range of sources and bought by a wider range of customers, from small scale fish mongers to multi-national processors.

The reputation of the seller is more important for remote buyers of fish than it is in livestock auctions because the standards for describing fish are less well developed. In close intensive networks the strength of existing social ties enables the buyers to buy based on their knowledge of the seller, confident that sellers will not behave opportunistically. In close networks opportunism is controlled by the knowledge that it will prevent the other party from trading with you again and there will be costs if they tell others of the behaviour. In anonymous perfect markets these pressures are much less. It was therefore the literal insularity of the Icelandic fishing industry which enabled buying on description to be successful without a complex system to guarantee descriptions. In Scotland, while LFC through Euroscot, could introduce selling on the basis of description for a sub-network of boats and their customers. In Grimsby the electronic auction planned for Dutch plaice was also for a well-defined sub-network of beamers and their habitual customers in the Netherlands. To introduce a market open to all bidders and sellers requires a means of guaranteeing the transactions, specifically guaranteeing to sellers that they will be paid and to buyers that they will receive the fish described. It was the necessity of these institutional roles which led to realisation that INFOMAR would have to operate through existing markets rather than bypass them.

## 8. Building Electronic Auctions

*“The farmer is not so much within reach of information as the merchant and manufacturer; he has not, like those who reside in towns, the means of ready intercourse and constant communication with others engaged in the same occupation. He lives retired; his acquaintance is limited and but little varied; and unless he is accustomed to read, he is little likely to acquire any other knowledge of his art than what is traditional - what is transmitted from father to son, and limited in its application to his own immediate neighbourhood”*

*Preface to Rigby's Translation of Chateaubriand on the Agriculture of Italy*

## Introduction

This chapter considers the processes which shaped the electronic markets studied. In each case the electronic market required the construction of a heterogeneous network of technical and social elements. Following the model of Callon (1993), we shall consider the building of electronic auction systems as a succession of phases. In Callon's model, the first phase is *conception* in which the negotiation space is created and resources enrolled, which is followed by the *adoption* phase during which a community of users is enrolled. In the analyses of electronic market systems these two phases in which the technology may be seen to be being formed are followed by a *stasis* phase in which the development of the system and its social network is frozen and a *decay* phase in which the social network contracts. The reasons for this pattern are discussed.

## Conception

The first issue faced in a network analysis of an innovation is to explain how the network began. Williams and Edge (1996) criticised Callon's Actor Network Theory, claiming it neglected the influence of pre-existing relationships amongst the entities enrolled into a network. The translation of entities will be influenced by the prior knowledge of them, whether social, abstract or technological entities. This knowledge combines direct knowledge of actants in direct contact with each other, but also an awareness of elements beyond each actor's direct experience, for example systems elsewhere. The texts which circulate and shape actor's knowledge of other entities are equivalent to Latour's *mobiles* (Latour, 1987) which embody knowledge. Alternatively, they may be viewed as Foucauldian discourses (Foucault, 1973). In comparison to Latour's mobiles, Foucault's discourse analysis considers how discourses develop coherence to disguise power and create the reader as their object.

For sellers, decreasing competition was posed as a problem in agricultural discourse as buyer concentration increased. For some existing intermediaries the growth of direct buying was perceived as a threat. These discourses laid out the problem, but it was their conjunction with two other discourses which led to the initiation of electronic market development: a discourse on the potential benefits of information technology and an economic analysis of market failure. These two discourses, to borrow the terminology of Granovetter (1985), led to an under-socialised analysis of agricultural markets, in which unsocialised technology would be applied to anonymous markets.

The seminal system in triggering interest in electronic markets was Telcot, developed by PCCA in partnership with IBM to automate an existing market community, with IT offering the prospect of more efficient trade within the community. Telcot therefore united the IT and market economics discourses, but once established created its own discourse describing the impact of actual electronic markets, which as we

shall see later was used to legitimate the futuristic and theoretical discourses of IT and market economics respectively.

### *Initiation*

The genesis of an electronic market was seen in the cases to take place amongst existing auctioneers, sellers and IT suppliers., from which the network of users and technological elements could be assembled. The only necessary elements in the assembled network are sellers, buyers and IT suppliers, as was seen in the TABROTEC pig auction in the UK. To go from conception to a viable market requires the assembling of a network with the social and technological structure to encompass many producers and processors, linked by an electronically based intermediary.

There are three routes by which this intermediary was formed:

1. new entrants;
2. seller co-ordination;
3. existing intermediaries;

### *New Entrants*

Malone et al. (1987) identified electronic markets as a potential opportunity for new entrants to sectors. According to Malone et al new entrants could set up an electronic intermediary, offer lower transaction costs than existing intermediaries and sign up sellers and buyers to their system. One of the earliest parties to take an interest in electronic auctions in the United Kingdom was the IT and network operator Istel, who were developing a system to bypass existing intermediaries. During the system's conception phase it was realised that Istel lacked the expertise to enrol a network of agents to source livestock off farms. In 1987 they sought to enrol existing auction companies to source the stock. Istel organised a seminar in London to canvass interest in the livestock industry for an electronic auction system. The most significant effect of this presentation was to make United Kingdom auctioneers, including ANM who were already aware of the CALM system in Australia, aware of the existence of electronic auction systems in Canada. From this process of failed enrolment by Istel it is seen that the barriers to a new entrant creating a market were: a lack of links to existing producers and suppliers; no access to industry specific expertise, in particular carcass grading in the livestock industry; lack of legitimacy, combined with suspicion of their lack of expertise and the embeddedness of existing market relations; and defensive reactions by existing intermediaries.

### *Seller Co-ordination*

The second locus from which an electronic may be created is through the co-ordinated action of producers. The increases in direct buying problematised electronic markets for producers who feared they were being exploited in non-competitive markets. The two clearest examples studied of producers initiating electronic market systems were Tabrotec in England initiated by a pig producer and NELCM in Australia initiated by a group of cattle producers. Taylor, who founded Tabrotec, was able to enrol GEC to provide technical resources during the conception phase and a small number of producers and buyers during the adoption phase. Taylor claimed that Tabrotec failed because of the difficulty for a producer of enrolling producers in other areas of England and the failure to translate abattoir buyers into users of the system. As was the case with Istel, he sought to overcome the first of these by enrolling existing intermediaries, but again they resisted being enrolled into a system which they could not control. The adoption phase of Tabrotec may therefore have failed because Taylor lacked the existing social network to enrol a viable community of users. For NELCM in Australia the instigator, Wright, was a producer more socially embedded within the industry, with links to research bodies and a collective of producers. This social network provided the a local foundation for the development of the electronic market which Taylor lacked. This network of producers was able to enrol through Wright's position as a producer representative on the Australian government's Meat Research Committee an awareness of electronic marketing and the resources to fund the development of a pilot system. During NELCM development advisory panels of both producers and processors were consulted on the design of the system's functionality. The conception phase of NELCM therefore exploited links between New England producers and links they had with processors, researchers and government agencies.

In a dispersed market, where sellers are negotiating with potential buyers, the isolation of the seller places them in a weak position to locate the buyer who will be willing to pay the most. Where the buyers are buying from many sources, as is typically the case in agricultural produce where the pattern is to have a large number of farms selling to a much smaller number of wholesalers and processors, the buyers will be negotiating from a position of having a much greater knowledge than the seller about prices being achieved elsewhere. This information asymmetry in dispersed markets favours the buyer.

A centralised market may be attractive to a seller as a means of placing their goods simultaneously in front of an array of potential purchasers rather than the one who happens to be passing, and gives them much greater knowledge of the prices being achieved by other sellers. It was to gain these benefits of centralised market places that the first local markets emerged in the middle ages, bringing together sellers of agricultural produce to a fixed place on a fixed day. Both ANM in Scotland (the founders of EASE), and Equity in the United States (the operators of NEMI) are co-operatives founded over sixty years ago, so

may be seen as producers collectives. However, their size and longevity was seen in both cases to have led to them operating as intermediaries rather than as social networks of producers.

### *Existing Intermediaries*

Third parties and producers faced the problem in building an electronic market community in that they would have to translate entities with whom they had no pre-existing social links. For existing intermediaries the construction of the network was found to be facilitated by exploiting their existing social linkages with producers and processors. For intermediaries the management of the marketing channel is central to their business and they are in contact with large numbers of producers and buyers. In addition, they may have links to information technology expertise in the firms which supply their administrative computer systems. Moreover, as they handle large volumes of transactions an investment to improve the efficiency of these transactions may appear attractive. Initiatives by existing intermediaries has been the dominant route by which electronic markets have been established. This includes OLEX, all the continental vegetable and fruit markets, all the fish markets and all the United Kingdom livestock markets (with the arguable exception of CLASS/SLAM/Agvision). Where electronic markets have their roots outwith existing intermediaries they still display a tendency to become closely linked to existing intermediaries, as seen in the cases of NEMI, CLASS and CALM. Existing intermediaries are positioned at the centre of existing social networks surrounding markets and are in close contact with both buyers and producers and will have expertise in the assessment and description of the produce they trade in, giving them legitimacy to potential users of an electronic system. The most significant group of intermediaries in the formation of electronic markets are existing market operators, whether of livestock, fish or vegetable auctions. These operators will often have the resources to build and operate the electronic market.

Intermediaries could problematise electronic markets as a response to the threat posed to them by the growth in direct buying. However, for intermediaries to see this potential required an awareness of the feasibility of electronic markets. To gain this awareness weak links (Granovetter, 1973) provided a mechanism for this awareness to spread. Wright's visit from Australia to Scotland awakened ANM's interest in electronic markets and the presentations by Martin in 1985 and Istel in 1987 to auctioneers raised awareness. Once translated into auctioneers who saw electronic marketing as a solution to their decline, the launch of EASE led to a rush amongst auctioneers to join either EASE or one of the competing systems. In the Continental electronic markets, because the linking of markets and the opening of markets to remote buyers were incremental changes to existing markets, the co-ordination of this process came from existing market operators.

In two cases, the Ontario Pork Marketing Board and PCCA in southern United States cotton trading, the introduction of electronic market was instigated by producer co-operatives who were tied to a community of producers. In these cases the motivation was to use electronic marketing to create a more efficient market and the uncertainty about whether producers and buyers will use the electronic market is removed by the limited existence of alternative marketing channels. This monopoly reduces the risk during the adoption phase by allowing the investment to be assessed against predictable future trading volumes.

### *Enrolling of Financial Resources*

The creation of an electronic market system required the development of the necessary software and installation of hardware. For early systems these costs were high, with the development of Telcot costing \$2 million. The resources for development were either sought internally by the instigators (OLEX, NEMI, EASE, Beacon, Direct, Lean, CLASS, TENGILL, BODI) or were sought from public sector sources. All the systems developed entrepreneurially after Telcot were largely emulations or licensed versions of existing systems. The systems which sought to develop new forms of electronic marketing (CALM, CATTLEX, EMA) were each partially funded using public support.

In the United States the USDA programme of 1979 supported six electronic market systems. This programme was influenced by the paper of Henderson, Schrader and Turner (1976). In this paper three academic agricultural economists proposed electronic markets as a response to a perceived lack of competition in agricultural markets. To problematise the US government they deployed the rhetorical arguments of greater competition in electronic markets linked to the practical example of Telcot. Having persuaded the USDA of the potential of electronic markets as a solution to lack of competition in agricultural markets, the agricultural economics departments of universities were accepted as the locus for their development, combining the theoretical and technical expertise needed plus the links to buyers and sellers. One implication of building the USDA pilots from academic departments was that they developed in the restricted local communities in which the academics were socially embedded, rather than as national systems.

The enrolling of government support for the development of CALM in Australia followed a similar pattern. Rickards et al from the University of New England, New South Wales, refined Wright's interest in electronic marketing, proposing electronic markets as a response to uncompetitive markets, using the economic arguments supported by the example of NELCM.

In the European fishing industry, Andalsteinnsson was able to combine the economic arguments for greater market transparency and competition, the existence of trading of fish on description in Iceland with a vision of a pan-European fish market to enrol CEC support for Infomar. The attractiveness of electronic commerce's use as a policy tool to bring about social convergence, but the difficulty of its achievement, was recognised by Graham et al. (1994). For the European Commission electronic commerce is seen as a means of overcoming existing spatial diversity in markets. Underpinning the European Commission's policy towards electronic commerce is a belief that it is a means of turning the single European market from an idealised concept into a practical reality, as described in the INFOMAR project in chapter 7.

In the United Kingdom the level of government support for electronic markets was negligible and academics were far less closely involved in the justification for electronic livestock markets than in the United States and Australia<sup>44</sup>, mirroring the less influential role of academic agricultural economists in government agricultural policy. The lobbying of the multiple retailers, who favoured an increasing role for direct buying to improve traceability and quality, led the United Kingdom government to accept the decline of live markets, as stated in their 1991 publication *Our Farming Future* (MAFF, 1991). This policy was reinforced due to the BSE crisis, which made traceability and quality more significant issues than theoretical market efficiency. The policy of encouraging farms to be certified in the national farm assurance schemes can be seen as an adaptation of the generic quality management system approach advocated by the Department of Trade and Industry for the ISO9000 standard for quality management systems. This encouragement of farm assurance was again closely aligned with the large retailers' desire for improved traceability and closer links with a small number of accredited farms, even though from a market economic analysis this is in opposition to the ideal of the anonymous perfect market.

### *Market Knowledge*

Where a system was instigated from within a technology firm there was a need to enrol industry specific knowledge. The three cases in which this was the were Istel, Lysis and Newline. Istel, a systems developer, saw electronic markets as a means of exploiting their network infrastructure, while Jones of Newline, who set up the CLASS satellite auction system, and Brickwood of Lysis, a system development company, both believed there was a potential market for operating another system derivative of EASE. All of these three sought to enrol existing market operators to gain access to industry specific expertise, but with mixed

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<sup>44</sup> The exception was the financial support of the quango economic development body, Highlands and Islands Enterprise, for the fish auction system in Scotland.

success. On being taken over by AT&T, Istel managers halted the project. Istel managers involved claimed that they had realised that it would be difficult to operate a commercial system on Istel's cost base. Similarly, Brickwood of Lysis was forced to cede control of LEAN to a consortium of market operators to make the system viable. Newline and Lysis were both small systems companies with experience of supplying administration systems to livestock auctions, giving them contacts in the industry and an awareness of its culture. It may not be coincidental that the most successful was Jones of Newline, whose operation of a credit monitoring service gave a deeper knowledge of the industry and also contacts with abattoirs as well as markets, but he too was forced to sell CLASS to Midland Marts, an auctioneer. Istel, a systems developer who saw electronic markets as a means of exploiting their network infrastructure, Jones of Newline, who set up the CLASS satellite auction system, and Lysis, a system development company whose managing director, Brickwood, believed there was a potential market for operating another system derivative of EASE. All of these three sought to enrol existing market operators to gain access to industry specific expertise, but with mixed success. On being taken over by AT&T, Istel managers halted the project. Istel managers involved claimed that they had realised that it would be difficult to operate a commercial system on Istel's cost base. Similarly, Brickwood of Lysis was forced to cede control of LEAN to a consortium of market operators to make the system viable. Newline, Lysis and Xavier, the developers of the DIRECT system for County Auctions, were all small systems companies with experience of supplying administration systems to livestock auctions, giving them contacts in the industry and an awareness of its culture. It may not be coincidental that the most successful was Jones of Newline, whose operation of a credit monitoring service gave a deeper knowledge of the industry and also contacts with abattoirs as well as markets, but he too was forced to sell CLASS to Midland Marts, an auctioneer.

### *Technological Expertise*

Where the instigators of the electronic market system lack technical expertise it will be necessary for this expertise to be enrolled. The operators of live markets studied believed they understood the industries in which the system would be used but generally lacked technical expertise in information technology so had to enrol it during the conception phase. The most frequently observed pattern was for operators of existing markets to contract with specialist system developers to develop a system meeting their specification. In most cases this division of expertise was aided by the operators specifying a system emulating an existing system and an existing auction mechanism, closing off questions of system functionality.

The small size of the companies operating most of the electronic markets made it difficult for them to maintain their own technical expertise to support the systems during the adoption phase. Only Telcot and CALM were able to maintain technical support teams, with BEACON and APEX in the United Kingdom

each employing technical specialists, but these focused on the maintenance of the systems for current users rather than directing their efforts to developing it for other markets.

There is a distinction between the relationships in the Continental system implementations and all the other system developers. Both Nieaf-Smitt and SCS see themselves as suppliers of systems to market operators, offering a modular structure of server hardware, communications medium, auction mechanism and bidder hardware to be tailored to the needs of the system operators and giving users confidence that the systems could be upgraded. All the other developers were focused on developing a system to a customer's specification, so there was little flexibility for adapting the system for other markets or upgrading. Luc Schelfhout argued that SCS were system architects rather than purely system suppliers, combining a service to system operators based on their experience in analysing the overall social structure of markets with their knowledge of the technical components of the systems. Their approach to systems design fits with Law's concept of the heterogeneous engineer (Law, 1992) and Hughes of the seamless web interweaving the technical and social (Hughes, 1988), tackling seamlessly the technical and social aspects of the markets being developed, whereas in other systems the technical developers were working to a technical specification unaware of the organisational milieu the system was going to be introduced into.

### *Technology*

The technological elements of the electronic market systems studied comprised three elements which had to be determined during the conception phase: the central processor used to run the markets, the devices used by remote bidders to access the market, and the telecommunications system linking bidders to the central system.

### *Technology at the Hub*

With access to financial resources, technical expertise and industry knowledge, the technology of the proposed electronic market system can be determined during the conception phase. In selecting the technical elements the actor-network is constraining how the system will operate: from the perspective of the initiators the combining of the technical elements and the functionality of the software embed a vision of how the future system will be used. During the conception phase of an electronic market three distinct technological elements must be defined: the central system which runs the auction, the communications linkages to remote users and the hardware used by remote users, with choices concerning each of these elements. In analysing the history of electronic market systems there is an apparent evolution in the technology used at the centre, for communications and at the remote user.

The earliest remote auction systems used teletype machines to link bidders to a central auction, but this ingenious use of an established technology was limited in both its flexibility, due to it being hard-wired, and restricted in the numbers of buyers who could be connected simultaneously. From Telcot in 1975, with the exception of telephone auctions which migrated to satellite, all the remote markets studied have used computers as their central platforms. As computers became more widespread in the nineteen seventies it became apparent that computers could be used to control the auction, with the advantage over teletype systems of integrating with computer systems administering the transactions. The barrier to the use of computers in the seventies was the high cost of the hardware and programming the computers, requiring the enrolling of sources of resources. The earliest electronic markets used dedicated mainframes to run the auction (CATTLEX, HAMS, Telcot, CALM, OLEX), but for a market operator a mainframe computer system represented an expensive investment which would only be fully utilised when the auction was running and the use of mainframes led to high maintenance costs. The need to enrol resources to cover these costs was seen as an explanation for the failure of the CATTLEX pilot in the United States and was identified as a weakness in attempts to license the CALM system for users outwith Australia. The barrier of high computer costs was overcome by NEMA, the USDA funded pilot, by enrolling a computer bureau service, so the market operator only had to buy time on a computer to run the auction. The same barrier was overcome imaginatively by Taylor with TABROTEC who developed the system enrolling the United Kingdom national Prestel videotext system and by LEAN, the smallest of the United Kingdom livestock auction systems, which runs its auction on a computer based in the offices of Lysis, the system's developers. The proposal by Zeebrugge Fish Market to run PEFA on a managed Web site is also effectively the enrolling of a bureau service, removing the need for day-to-day involvement in the technical management of their auctions. The enrolling of a computer services company into the network therefore reduces the capital investment required in hardware and Internet connections to launch the system, provides access to specialist expertise and reduces the risk for other actors if the electronic system is not financially successful. Through the eighties, the barrier to operating electronic markets arising from high computer costs and the attractiveness of enrolling bureau services both fell with the advent of lower cost UNIX computers designed for multi-user applications and the growing capabilities of personal computers. The falling price of computing made the use of DEC VAX computers (OLEX, EASE), UNIX systems (LEAN, BEACON, TENGILL, BODI) and PCs (DIRECT, APEX, NEMI) more economically attractive. Whereas the hardware and software cost of setting up EASE in 1989 exceeded £250,000, by 1994 County Auctions were able to set up the equivalent Direct system for £50,000 by basing it on a standard IBM-compatible personal computer.

### *Technology at the User Interface*

To enrol users onto an electronic auction system they must be provided with a means of bidding. The earliest remote markets used teletype machines which dialled into the central machine. The replacement of these by dumb terminals linked by modem to the central host involved minimal changes for the bidder because the dumb terminal provided the user with an interface similar to that in teletype auctions. In both they had a terminal printing the progress of the auction onto paper, using a key on the machine to bid. The central computer fed a stream of data to all the remote users describing the lots and the latest bid price and, finally, the confirmation of final price and successful bidder. Bidders bid by entering the return key on their keyboards. The Prestel receivers used in TABROTEC were also dumb terminals, but displaying the auction on the user's television screen.

The growing use of personal computers in organisations and their falling cost made possible the use of a PC using software to emulate a dumb terminal. While buyers connecting to Equity's auctions in the United States used dumb terminals, providing a hard-copy print-out, personal computers emulating dumb terminals became the standard connection to the EASE system in the UK, with bidders watching the auction on their PC screen rather than spooling off a printer. The main weakness found in using personal computers to emulate dumb printer terminals was that the information scrolled up the screen until lost at the top, with the details of the lot possibly being lost prior to the auction being completed. A second weakness found was that with dumb terminals there could be no time stamping of the bid, so it was possible, particularly if the network was overloaded, to have a bid held up and overtaken by a bid from another bidder, resulting in the bid being accepted for the next increment in price. Bidders were unhappy on the EASE and APEX systems if the system accepted from them a higher bid than they had intended to make. If bidders were bidding using computers that had the capability to do processing at the user end, it was an incremental step for developers of systems emulating EASE to make use of this facility. The developers of livestock marketing systems in the United Kingdom following EASE looked for ways of incrementally improving the systems for users. DIRECT, BEACON & LEAN all replaced the scrolling screen with a stable screen in which the details of the lot for sale stayed visible on the screen with the bidding shown in another area of the screen. BEACON also introduced the time-stamping of the bids from the remote terminal to ensure they were accepted at the correct price and used colour to make the screen more easily intelligible to users. The enhancements in the BEACON system required that the remote users used a personal computer to connect to the auction as they depended upon software resident on the bidding machine to handle the display and the timing of bids. In these cases we again see that EASE represented the functional model for the following systems in Britain and development during their conception phase was restricted to a small number of incremental improvements.

### *Technology of Connection*

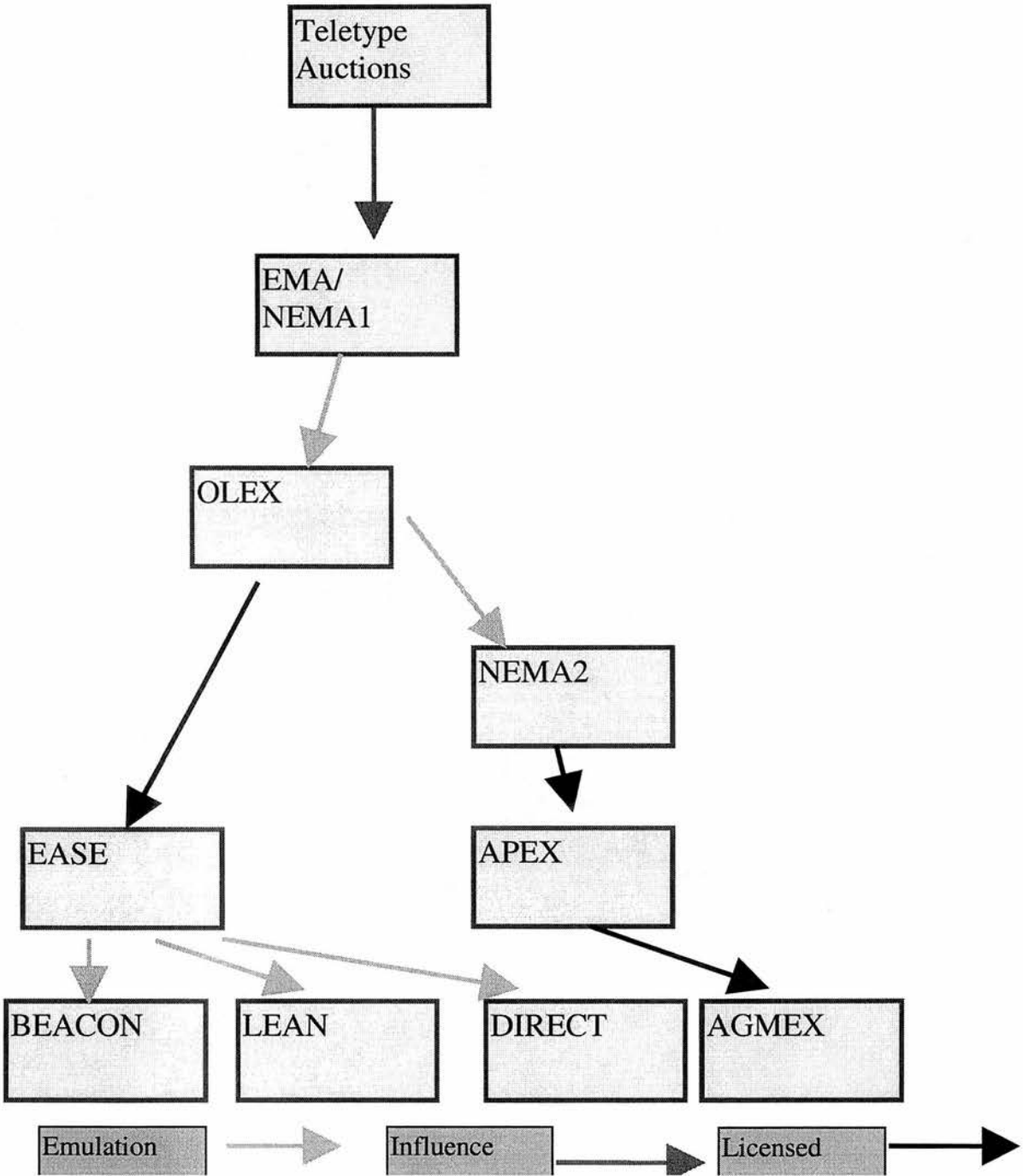
To enrol users onto an electronic auction systems a means must be determined during the conception stage to links buyers to the system's hub. The earliest electronic market systems, following their roots in teletype auctions, used direct dial-up by modem to the central host computer (Telcot, CATTLEX). This required the central computer to maintain a bank of modems to receive the incoming telephone calls. As the number of potential bidders connected onto the system increases, the feasibility of using direct dial-up decreases because of the technical complexity of interfacing with multiple modems and the costs to users of having to pay for long distance connections. In the first NEMA system the use of a bureau computer service overcame the limitation of the number of simultaneous connections, with every user dialling a local node of the computer bureau service. Similarly with TABROTEC, users dialled in using their Prestel terminals to a local Prestel node. The appearance of the BT Dialplus connection to their X.25 network, created to support inter-firm data transfer, allowed an architecture based on a single fast connection between the network and the central host, with individual users connecting at slower rates to their local Dialplus nodes. In this architecture the speed of data transmission between the network and the host and the software on the host became the limitation on the number of users who could be connected simultaneously. For the competing United Kingdom livestock auctioning systems the data transfer rates were sufficient to meet the needs of the, in retrospect, optimistic predictions of user numbers. A move to faster networks would be required if systems moved towards the transmission of graphical images of the stock for sale. The alternative development in networks is the potential of using the Internet to connect users to the central hub. Internet connections are currently cheaper than ISDN or the use of X25 networks, but the potential flaw in the use of the Internet for an electronic auction is the uncertainty of the band-width of Internet connections. The use of the Internet has been investigated by BEACON and is planned to be used by Zeebrugge and INFOMAR. Therefore in all the cases described the linkage between the buyers and the central hub was achieved by enrolling an existing telecommunications medium, whether telephones lines, data networks or the Internet.

### *Evolution of Electronic Auction Systems*

During the conception phase the auction mechanism and technology used can be designed by the actors in the network taking a fresh view of their ideal electronic market. However, in many cases the systems studied were either licensed versions or emulations of existing markets. The mechanism in the early teletype auctions emulated the traditional English auction while the mechanism in the earliest Continental electronic auctions emulated the existing mechanical clock auctions. In the following livestock markets the EMA system, which itself emulated the teletype systems, provided a model for the OLEX, NEMI, EASE,

Beacon, LEAN, Direct and AGMEX systems, either through the licensing of software or by emulating the parent's functionality.

Figure 2: Genealogy of EMA-related Auction Systems



### *Satellite Systems*

The process of the technology emulating, and therefore enrolling, aspects of existing market systems was also seen in the Superior and CLASS satellite auction systems. The evolution of satellite auctions followed from the opening up of conventional auctions to telephone bidders in order to widen the spread of potential bidders. Telephone bidders in live auctions have the disadvantage that they either have to pay someone to attend the sale or rely on a third-party description. The seventies saw the emergence in the United States of America of video auctions in which stock were videoed, the video tape copied, the video of the lots for sale displayed simultaneously at a number of locations and an auction would be held linking these locations, allowing the livestock to stay on the ranch and giving each bidder equal information. The next stage was to replace the video tape distribution of images with satellite broadcasts, allowing the bidders to bid over the phone from any location. As described in chapter three, the satellite auction combines the benefits of a geographically dispersed market without the need for stock to leave the ranch prior to sale with many elements of the traditional stock-yard sale, including the auction mechanism and the language. Indeed the use of a televised professional auctioneer operating in a saleroom in a hotel with many of the buyers, sellers and agents present means that the system simulates the social significance of the “real” auction.

It may be argued that the qualitative difference between information technology and other technologies is its flexibility. While this flexibility can be interpreted as a potential to start with a clean sheet and develop applications with radical effects, it also conversely allows the technology to shaped to fit the existing social structures and therefore have limited impacts. The cases demonstrated that where this flexibility was used to develop markets which appeared theoretically more efficient, the systems failed to gain acceptance, as seen with CALM and CATTLEX, but where they emulated existing processes they were more readily accepted by users.

### *Classification*

While the elements of the electronic markets were generally assembled from existing elements, both technological and social processes, the main area in which an electronic market differed from an equivalent live market is the need to describe the products for the potential remote bidder. During the conception phase of an electronic market the actors may determine the classification system used to describe the lots on offer. Relative to the live market the bidder in the electronic market is faced with two additional sources of uncertainty. First, they are buying on the electronic market in the present for future delivery, exposing themselves to the uncertainty of incorrectly forecasting the “market price” on that date.

Second, whereas in the live market the buyer can make a direct inspection of the stock and assess its quality, in the electronic market they are dependent upon the provided description. The information provided to the potential bidder to construct their valuation is therefore an amalgamation of two constructs: the utility of the lot to them, derived from the description provided by the market company, and the market price. In designing a system of description a construction of the buyers' process of valuation is drawn on, including the information they use and how they use it. They implicitly predict how the buyer will use the information provided. The development of a system of description therefore depends upon a construction of the buyer.

The value of a lot to a buyer is socially constructed and the systems of description and the processes of description are institutions embodying the conception network's beliefs about this socially constructed value. During the conception phase a remote market systems there has to be agreement about how the systems would describe and assess the stock. In doing this three inter-related areas of choice exist, with in each case a balance between the expected cost of the process and its impact on buyers willingness to bid. The first choice is between developing an elaborate system giving very detailed information to potential buyers or having a simpler and thus lower cost system. The second concern is the balance between establishing an independent mechanism for assessment and the lower cost alternative of having producers describe their own produce. The third concern is the apportionment of the risk of misdescription.

#### *Description Complexity*

In the markets studied the buyers were usually buying on behalf of large processors, who will be buying through a range of markets. Where the buyer is buying on behalf of a client or employer they must be able to explain the types of stock they are looking for, but this language may be idiosyncratic for each processor. It may be that they describe the appearance of the stock they seek, or simply ask for some more stock like a lot bought at an earlier sale by the same buyer. However, in an electronic market the descriptions must be standardised across a network of buyers and assessors.

In the cases studied the social construction of a system for valuation was generally aided by the use of existing product description standards. The establishment of the Telcot cotton market system was aided by the existence of the mandatory USDA grading of cotton prior to sale using independent assessors. Similarly the pre-existence of carcass classification systems provided a foundation for product description systems in the electronic markets. These systems in the United States and Europe were developed for assessing carcasses to provide market statistics in the United States and as a basis for public administration market intervention in Europe. Carcass classification rather than live animal assessment had the advantage of being linked more closely tied to the meat processors' needs of carcass quality than a live assessment

system. Using these pre-existing standards in the electronic markets also had the advantage for market developers that processes existed for inspecting carcasses to these standards, removing the need to introduce an additional stage of inspection. The disadvantage of adopting these systems for electronic markets has been that they were not designed for predictive assessments of live animals. While the livestock systems could make use of existing processes for carcass assessment and existing carcass classification systems, because it was decided to emulate the conventional live markets and sell livestock prior to slaughter, the descriptions provided to potential bidders were predictions of the carcass grades. An additional stage was required to assess the stock prior to the sale, so there is the risk of variations between the assessment of the live animal prior to the sale and the inspection of the animal's carcass later. In the United States this gap was found to be particularly significant because the USDA grading scale included a dimension for the marbling of fat through the meat, which can be predicted from a knowledge of the feeding regime of the animal but cannot be assessed from a live inspection.

In fruit and vegetable markets the mandatory grading of stock in the market was adopted in Continental electronic markets, but it was claimed by Luc Schelfhout that the system lacked the discrimination for remote buyers to be confident of bidding without inspection. It was claimed that remote buyers either had the lot checked or were influenced by the reputation of the seller. The establishment of electronic livestock marketing in the United Kingdom was aided by the existence of the EC Carcass Classification System, otherwise known as the EURO grid, and its mandatory use for classifying carcasses in abattoirs. The grid was agreed in 1981 with the intention of using it to determine prices for carcasses bought into intervention stores to support the European meat market, so was not developed to be used in electronic markets.

Relative to livestock, the standards in the United Kingdom for fish description are rudimentary. In the quay-side auction the buyers assess the quality, and in practice quantity, of the boxes of fish by picking the boxes up and handling and smelling the fish. In Europe fish are graded into three categories, but with the majority of fish for the electronic markets graded "excellent" the system provides little useful information to buyers. It was claimed by all the fish market operators that a more detailed classification was needed for buyers to have confidence to buy without direct inspection. To have every box inspected, graded and described represents an additional cost in the system. At Lochinver deciding who would carry out the description of the fish and who would pay for it became a major barrier to the operation of electronic market. Zeebrugge have adopted the Torry classification system developed in Scotland, while the Dutch auctions use the Dutch REVO system, and the two Icelandic systems each developed their own standards. As auctions open up to remote bidders, these bidders will have to be familiar with the description systems used therefore the operators claim to see an advantage in a unified consistent European standard.

Therefore, while the description of the lots provided to buyers can enable them to make a valuation, no classification system can provide the buyer with perfect information. The reliability of descriptions also reduced where an existing system of description not developed to meet the needs of electronic markets is adopted in the electronic market. This incorporation of an existing system of description reduces the cost of assessment for market operators and is familiar to potential users. This familiarity is expected by operators to aid buyers incorporating the descriptions into their construction of value, but the naming of the producer and the assessor implies that vendor reputation is also a factor in the construction of valuations. This incorporation of reputation in valuation takes the electronic market away from the idealised perfect competition as envisioned by Henderson et al (1976). However, in observing traditional livestock and fish sales in the United Kingdom the reputation of vendors was an important influence on buyer valuation in addition to direct inspection/observation of the stock. As discussed in chapter 3, the existence of character fairs in nineteenth century Scotland shows that the significance of reputation in the valuation of livestock is not a recent phenomenon.

#### *Assessment Independence*

After selecting a classification system the developers of electronic markets had to select who would inspect and describe the lots for sale, in practice this is a decision between allowing producers to describe their own produce, the market operator describing the lots or an independent third-party being contracted to undertake descriptions. For the operator the cost of assessment appears lower if undertaken by the producer and higher if undertaken a third-party. In industries with mandatory pre-market third-party grading, as in the United States' cotton industry, this choice was not an issue because independent grading was effectively free. The barriers identified to allowing producer descriptions were that buyers would lack the confidence in buyers' descriptions, both because of their lack of grading expertise and the fear that producers would mislead by over-emphasising lot quality. In the USDA pilots, the Canadian systems, CALM in Australia and the United Kingdom systems the systems initially operated with assessors employed by the market operators. In all the systems the cost of maintaining a network of fieldsmen became a major variable expense in operating the electronic market. As the markets failed to achieve the expected levels of sales, producer grading became attractive as a means of cutting costs. In Canada there was initially an expectation that once sellers had become aware of the grading schemes in use and buyers had developed confidence in the gradings, it would be possible to reduce the proportion of assessments, allowing some producers to self-assess. The argument of the system developer being that the producer would realise that they would have no incentive to over-describe their stock as they would be disappointed in the price (where a price compensation grid was in use) and the buyer would be wary about buying from

them again. Electronic auction operators in the United Kingdom sought to cut their costs by switching from full-time salaried fieldsmen to using either auction staff temporarily freed from other duties, including one firm where a secretary was used to assess livestock, or using part-time self-employed fieldsmen working on commission. Increasingly, to save further cost, auctioneers followed the Canadian model and allowed producers to describe and assess their own stock. In these cases the bidders were unaware that the stock had not been assessed by the nominated fieldsmen. Effectively the operator was using the farmer's reputation to allow them to assess their own stock. The cost of skilled fieldsmen inspecting on the farm all the livestock offered for sale became a major expense for the system operators. In electronic markets in the United Kingdom the narrow margins on sheep sales have led to a growth in producer description which is hidden because an assessors name still appears in the catalogue. In practice this is happening because the operators and their assessors are reaching a judgement about which producers they trust to describe their own stock without letting the buyers know, in which case the buyer is buying on the reputation of the assessor, who trusts the producer to carry out their own assessment. Lind of APEX UK saw self-description of sheep by the farmer as acceptable if the farmer has a history of consistent grading, but that it would be more difficult in cattle - "*but not every farmer can do it.*"

The need for a non-producer assessment of quality was found to be a barrier to the formation of electronic fish markets. In these markets the model adopted by the instigators of the market was to follow the continental fruit and vegetable markets, opening the existing markets to remote buyers. However, it was expected that a more detailed system of description would be needed than the existing classification. This raised an unresolved issue for system developers about how the more detailed assessments would be funded: it was believed by the instigator of the Highland market that existing local buyers would resist the electronic market because they feared it would lead to higher commissions to fund the grading of the fish for the benefit of remote buyers but of no benefit to them and that differential commissions would be off-putting to remote buyers.

It was found that the importance of assessment independence falls the further the market moves away from being the idealised anonymous perfect market and becomes a trading community who know each other, in particular where the buyers have a knowledge of the seller's reputation. In the TABROTEC pig auction in the United Kingdom Taylor avoided using a grid of compensations and the need for product assessments by providing potential buyers with an analysis of that producer's previous carcass quality levels. In socially tightly linked communities buyers are more likely to be aware of each other's reputations and their are social pressures limiting obviating opportunism. This was seen in the ability in Iceland and Norway for boats to sell electronically fish on the description of the boat skipper prior to landing. Similarly, Denholm Fishselling in Lochinver, as an alternative to marketing fish through the market, sell fish direct to the

processors prior to landing, in this case partly on the reputation of the boat and partly on the reputation of Denholm. The knowledge that buyers in Scotland, Iceland and Norway were willing to buy from boats before they have landed their catch on the basis of the boat skipper's description was used by the proposer within the original specification of the INFOMAR project for the European Commission as evidence that a pan-European fish market in which buyers negotiated to buy fish from the boats was feasible. Once the project began it was decided that it was not practicable to scale this form of buying to a pan-European , with Thomas of Vega deciding after speaking to United Kingdom fish industry participants that when buying takes place from the skipper's description, the buyers are buying either through known agents or from known boats based on reputation. It was believed to be unlikely that buyers would be willing to trust descriptions made by boats about whose reputation they are ignorant.

#### *Apportionment of Risk of Misdescription*

The third aspect of the process of lot description in electronic market systems was the compensation of buyers for lots which did not match their description. This element in system design was particularly an issue for the livestock markets selling on the basis of a forecast of carcass description e.g. NEMI, OLEX, and the United Kingdom systems where abattoirs could bid on the expectation that carcasses would grade to specified standard and weight then find post-slaughter that they graded to a different fatness, conformation or weight. In designing a process for compensation the system developers had to construct a model of buyers' perceptions misdescription and apportion the risk between the seller, the operator and the buyer. NEMA, OLEX and EASE introduced grid systems based on a nominal grade with deductions and premiums. Effectively this reduced the price per kilogram paid for poorer quality than expected but increased it for higher quality. Similarly, CALM in Australia adjusted prices on the basis of historical price variations. System developers saw these corrections as adjusting for the variations in market price due to misdescription, but for the buyers interviewed they were seen as under-compensating for variation. They claimed that if they were buying to meet the needs of a grocery chain with a tight quality specification or for specific export markets carcasses outside the specification were of less use to them, so they received compensation for buying carcasses of a different market value but were not compensated for these carcasses not being of the type they wanted. The EASE grid compensated for variations in conformation and fatness but did not compensate for variations in weight, which was a problem for abattoirs needing to meet specifications on carcass side, for example export abattoirs meeting the Italian and Iberian demands for very small lambs. The later United Kingdom systems Direct and Beacon dispensed with the grid because their developers believed the grid compensations made bidding complicated for buyers and calculating income was complicated for producers. Beacon introduced one-way compensations for lambs

over-weight and over-fat relative to description. Whereas the compensation grids had been standardised for cattle and sheep, the Beacon corrections were agreed with the producer when the lot was submitted with advice from the fieldsman. A similar system of compensation was used in the Superior video auction in the United States which were weighed as being “overweight” when uplifted, termed “slide”<sup>45</sup>.

In the live auction it is the buyer who carries the uncertainty of fungibility, with the risk that the stock bought once slaughtered will not meet the needs of the processor. The producer by convention is guaranteed being paid the price offered minus commission on the day of the sale, in cash if necessary. If the resulting carcasses are of lower weight or quality than the buyer expected it is his loss. If the pre-sales assessment by the fieldsman was 100% accurate, the only effect of the grid corrections would be to complicate the process of calculating the real value of bids for buyers. In practice the grid corrections represent the loss/gain to producer and purchaser for stock which do not kill to the predicted classification. When introducing EASE the corrections were set at levels to encourage buyers to connect by limiting the premiums and increasing the penalties, but this had the effect of increasing the risk and uncertainty for producers, thereby making the use of EASE less attractive to them. While EASE used a grid to compensate buyers for carcasses which did not match the assessor’s prediction, DIRECT cattle sales dispensed with a grid, removing uncertainty for the farmer. It was recognised that this would require accurate livestock classifications. The CLASS satellite cattle auction also did not use a grid, partly because it was mirroring the form of satellite auctions in the states, which are primarily feed stock sales where a grid was irrelevant, and partly because the video images of stock were expected to give the buyer sufficient information to make their own assessment of quality. With the removal of the grid system the risk, and dissatisfaction, with inaccurate grading moves fully on to the buyer.

There is a paradox in the introduction of electronic auctions because auctioning is justified as a response to uncertainty about what the lot is worth, and therefore, by implication, exactly what it is. This is seen in the earliest auctions in which the buyer has to rely solely on their own expertise to assess the item, including its quality and, in the case of livestock, its weight. In electronic markets, in order to provide the buyer with sufficient information to assess whether they want to bid, the description of the item must be seen as reliable. However, if the description is sufficiently reliable for the buyer it may also be reliable enough for the seller to be willing to forgo the cost of auctioning the item, and enter into a direct sale on the basis of the current “market price” for that item. The electronic systems then become a source of pricing data to buyers and sellers who do not use the system to trade, made more useful by the certified discrimination on quality.

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<sup>45</sup> Cattle sold underweight are believed to have a higher value market price per kilo, so supplying underweight cattle would be the seller’s loss.

The introduction of reliable product description was therefore found to accentuate the free-rider problem which has dogged electronic markets from the start - where sellers and buyers, accepting a description of the item for sale, can take information off the electronic market system to determine the current market price. When discussing Australian public sector involvement in electronic markets, Rickards et al (1983) saw the free provision of market data as one of the system's benefits, but the free dissemination of this data undermines the reason for the market's existence. The United States National Cheese Exchange (NCE) only trades 0.2% of United States cheese production but the prices reported are used to set the prices for direct trades (Mueller et al., 1996). Mueller et al. (1996) argued that this leads to anomalous behaviour on the NCE, with firms who are predominantly producers trading on the exchange as buyers to bid the price up, and firms who are predominantly buyers trading as producers, ostensibly as a means of off-loading surpluses, but effectively to bid down the price.

The functionalist conception of an auction sees its purpose as being price discovery. When considering the roles of an auction it is important to remember that it also disseminates information, provides a financial guarantee to sellers and is a stage in the distribution channel. The auctioneers, as part of their service, publicise the auction to encourage buyers or their agents to attend, reducing the need for the producer to market their own stock. Also in most United Kingdom markets the pattern is for farms to bring to market lots smaller than a full trailer load, with the buyers buying several lots to make up a full lorry loads. The auction market therefore acts as a stage in the distribution channel, allowing small lots to be consolidated into larger lots for transporting to distant abattoirs. The second potential misconception in viewing traditional markets is to assume that they are classical anonymous markets, in which the buyers purely base their bidding on a visual inspection of the stock and an awareness of their requirements. In a pure market it would not be of value for buyers to know the identity of the seller. The greater the importance of the seller's identity in forming the buyer's valuation, the further the market has diverged from being a pure market. This has implications for electronic markets because they are justified on the basis that they improve market efficiency by broadening the market (Henderson, 1979), but if in broadening the market they lose the social capital and trust embedded in localised networks of traders, this justification for electronic arguments is undermined. The costs of operating systems of product description are costs counterbalancing the loss of trust in wider market networks. In tightly linked local networks, as described in chapter 7 when considering the use of remote bidding in Icelandic fish markets, it was believed that buyers buy on their knowledge of sellers' reputations, but in wider markets initiators of the markets would increasingly need an independent third-party to guarantee descriptions. The tendency of electronic market systems to operate through existing market intermediaries rather than be set up by new entrants may be seen as a means of exploiting the trust and social capital accumulated in the existing industry.

### *Effect of Information Dissemination on Markets*

One of the predicted effects of electronic markets is to lower the costs of information dissemination. The lowering of information costs enables buyers to extend their networks and sellers to be more aware of current market prices. The bilateral negotiation between a farmer and a buyer, in which the buyer is larger and in contact with many farmers, is conventionally seen as a negotiation in which the seller is in greater ignorance, putting the buyer in a relatively powerful position due to price information asymmetry. However, this apparently isolated transaction is part of a wider market if the buyer and the seller are both aware of recent sales made elsewhere, whether in physical auctions, electronic auctions or direct sales. In this scenario the buyer is not playing the role of an antique dealer “on the knock”, randomly knocking on farm doors in the hope that a seller will have no idea what the market value of their stock is. Instead, he is negotiating with someone aware of what similar stock have recently sold for elsewhere. The agricultural economics arguments for electronic markets were based on the assumption that the traditional livestock market represents more closely perfect competition between anonymous buyers and sellers, while direct buying represented the exercise of oligopsonistic power by buyers to distort the market in their favour. However, as was found in the Alberta hog auctions, where the buyers are an oligopsony, the introduction of a remote market can lead to a remote market in which oligopsony power is abused. The only means by which electronic markets could be expected to limit oligopsony power is through creating markets which embrace a larger population of buyers by covering a larger area. However, the potential for parties to arbitrage between markets in an environment where there is free price data dissemination and free market access may limit this advantage. The fact that traditional auctions are local auctions with a stable cast of sellers, intermediaries and buyers suggest that they are not perfect markets, but instead that the sellers’ reputations and linkages between sellers and buyers affect the bidding. The “perfection” of competition in large traditional markets is assumed by agricultural economists, but there has been no study of agricultural or fish markets to confirm such a view. Instead this thesis suggests that in reality they more closely approximate to Baker’s study of financial markets (Baker, 1984), which found sub-networks and cliques buried in the apparent homogeneity of the overall market. While agricultural economists and policy makers have seen the growth of direct selling as a problem, this behaviour suggests that it is less of a problem for the sellers. The increase in direct trading can be seen as a consequence of greater quality discrimination by buyers, with reliable product description standards leading to wider price variation. In the nineteenth century a farmer would have had to be trusting or gullible to sell stock directly to a buyer because he would have been partially ignorant of current market prices, with the market results published in local papers not giving weights or any indication of quality. The wide dissemination of price and availability data in electronic markets, which many of the instigators of systems saw as a means of reversing the trend

towards direct buying, may paradoxically accelerate the trend to direct selling. With reliable dissemination of direct sales prices linked to reliable quality specifications, the single buyer negotiating with the single farmer would be part of the wider market. This free dissemination of reliable price information therefore largely removes the justification for using auctions as a price discovery mechanism. While existing auctioneers seek to defend their position in their industries by establishing electronic markets, a case can be made for public support to improve market efficiency being directed to ensuring market transparency. The barrier to this is that while such a move may be in the interests of both overall market efficiency and the producer, it is not in the interests of either intermediaries or auctioneers. Producers lack the sectoral coherence to militate for and co-operate in an enforced transparent market. To ensure market efficiency, reliable price reporting of direct trades, as has evolved in live livestock markets and is evolving in fish markets, may be a more effective policy than seeking to use information technology to automate existing market mechanisms. The USDA policy in 1978, the AMLC support for CALM and CEC support for INFOMAR can all be seen as conservative reactions to the decline of existing markets in that they take as given the assumption that a competitive auction is the ideal mechanism to ensure market efficiency. Such arguments overlook that equity markets operate through the transparent reporting of bilateral trades rather than through auctioning. Extending detailed, rapidly updated, price reporting into direct sales would also create a market environment complementary towards the moves for traders in the market to form bilateral relationships with traders. While direct buying has the advantages of traceability and directing producers towards the needs of their customers, the weakness of producers being exploited due to information asymmetry could be overcome by enforced reporting of prices and quality grades. However, any moves towards this market transparency might be opposed by buyers fearing the loss of asymmetric negotiation.

The conception phases therefore comprised the translation of existing social entities to create a negotiation space with the financial resources, IT expertise and industry specific knowledge to develop the system. In this the network is enrolling entities on the basis of pre-existing expectations of their capacity, translating them into elements that are within an electronic market system. In some of the systems studied, for example Istel, CALM and CATTLEX, economic theory was enrolled to improve the auction mechanisms, whereas the other systems followed less radical approaches, adopting existing auction mechanisms, carcass grading schemes and software. By enrolling existing elements the instigators both were trying to make the system more acceptable to users during the adoption phase and, by closing options, reduce the complexity of the conception phase.

## **Adoption**

Once developed the network established during the conception phase must be expanded to include users: translating buyers into bidders on an electronic system and sellers into suppliers of stock to the electronic system. If the dominant pattern is for the social networks to grow from existing intermediaries, the cases studied show that two patterns can be identified in the adoption phases of the electronic market community. In the electronic markets studied there is a distinction between markets which were developed in parallel with existing marketing channels and those that formed by allowing remote buyers access to existing markets. This decision is taken during the conception phase but sets the path for the following adoption phase.

### ***Parallel***

In parallel development, electronic markets form as an alternative marketing channel to conventional channels. This was seen in the livestock markets where electronic markets were an alternative marketing activity for intermediaries, offering their customers an alternative marketing channel. Parallel development potentially allows the market mechanisms and processes to be re-designed without carrying over past activities. However, as discussed earlier in this chapter, most of the auction systems studied simulated the structure of existing markets, providing a degree of familiarity for users. CATTLEX, the Texas feeder cattle auction, sought to develop a more efficient mechanism, but this was found by the instigators to make the system less easy to understand for users. The disadvantages of parallel development were twofold. First, the creation of parallel marketing channels could confuse buyers and sellers, especially where the electronic marketing system is operated by existing intermediaries, and second, the difficulty of persuading buyers and sellers to use a new sales channel in competition to established channels.

### ***Evolutionary***

In evolutionary electronic market formation the technology is used to allow buyers remote from a market to bid against buyers located in the market. This evolutionary pattern was seen in the fish markets, where the model for the application of technology was set by the Dutch and Belgian fruit and vegetable markets. In Continental vegetable and flower markets the conventional form of auction was a falling price Dutch auction in which the lot is sold to the first person to bid. Originally these markets were operated manually with the auctioneer judging who was the first bidder to bid, but early this century it was realised that the auctions could operate more quickly and with fewer disputes if a mechanical system was used to determine the first bidder and the price at which they bid. These systems developed from mechanical auction clocks,

with each bidder provided with a lever to pull, to the current electronic systems in which the current price is displayed on a screen and bidders have buttons to register their bid. With this degree of automation within the auction it was a small step to allow external bidders to bid over telecommunications networks. In the traditional English auctions, in which the auctioneer seeks increasing bids, there is little advantage in trying to automate the physical auction because each potential bidder has time to make their bid clear to the auctioneer. With no history of automation within auctions using English bidding, this evolutionary path to an auction accessible to remote bidders was closed off. The automation in Dutch auction markets led to the emergence of specialist market system suppliers, SCS and Nieaf-Smitt, who combined information technology expertise with detailed knowledge of the organisational context of the markets and close contacts with market operators, placing them in a position to develop remote bidding systems.

The problems of gaining sufficient bidders on the electronic system to create a viable market are overcome in evolutionary electronic markets because the remote bidders are simply additional participants in a local auction. The resistance of local buyers could be minimised because, having the opportunity to view the produce being sold, they have an advantage over remote bidders who will either have to depend upon the catalogue description or employ someone to carry out a physical inspection. This pattern was seen in the Icelandic fish markets and was the route followed by fish markets in Milford Haven and Highland. The evolutionary approach maintains and builds upon the existing market and, in the short-term at least, preserves the roles of existing market intermediaries. The disadvantage of evolutionary systems for remote buyers is that they are at a disadvantage relative to buyers in the market because they must rely on the description. Moreover, accurate and meaningful description is less crucial in an evolutionary electronic market than in parallel electronic markets because only the remote bidders require it, so there may be less pressure to develop and use accurate product descriptions. CALM sought to overcome the disadvantages of parallel development by organising *interface sales* in which the physical auction was organised as a live auction but the auction itself was conducted using the CALM system. In doing this they had taken a system designed for parallel operation and used it to create an evolutionary market. The response of the sellers, who were found to be willing to use the interface sales but were then unwilling to sell cattle through the mainstream remote system, demonstrates the advantages of an evolutionary approach for enrolling users with an existing construction of the market.

### ***Enrolling Intermediaries***

In an evolutionary development of an electronic market community it is axiomatic that the network process must involve the enrolment of existing intermediaries. This need to enrol intermediaries is in opposition to

the concept of disintermediation (Gellman, 1996), in which the electronic network displaces existing intermediaries. Istel sought to develop a livestock marketing system which would have bypassed the existing auction operators, but it was found that the complexity of building a network reaching out directly to farmers would be both very complex and they lacked the social linkages and expertise to enrol farmers. They then attempted to build the network of sellers by enrolling existing auction operators, but this process of enrolment failed because they in turn lacked the linkages with the auction operators. The Tabrotec adoption phase also failed because the direct enrolling of farmers was too complex for a single producer and existing intermediaries could not be enrolled. Also in the Infomar fish market community it was initially proposed that existing intermediaries be bypassed, but it was realised that Vega, as was earlier the case with Istel, as an IT company lacked the linkages to build a community of users. Realising this the adoption phase followed the competing PEFA system, with existing market intermediaries enrolled into the network in the expectation that they would enrol the boat owners.

The enrolling of sellers to the electronic systems is problematic because large numbers of geographically dispersed buyers must be enrolled, each of whom may only be an infrequent seller. The history of livestock auctions in the United Kingdom shows that the institutional structure of the markets influences their success in enrolling sellers. When ANM bought the rights to the Canadian OLEX system, they, along with many others in the United Kingdom livestock industry, believed that electronic selling would grow rapidly. They could have sought to set up a national network of fieldsmen to source stock for their system, but they believed this would have been expensive and that they lacked the contacts in many areas of the country. Instead they marketed the idea of electronic marketing to other United Kingdom auctioneers and, having generated an enormous amount of interest, franchised the operation of the system to regional operators who each had a monopoly for its use in their own area. For some of these franchisees the motivation was partly to become involved in electronic selling, but also by taking a franchise they believed that they would prevent anyone else trading electronically in their area. The franchise structure left the EASE franchisees in a weak position to influence the development of EASE, and it was this lack of control which made several auctioneers unwilling to join EASE. For the users committed to electronic selling, which included Colin Young in Easingwold and Frank Yeo in the West Country who had both set up businesses largely to source cattle for EASE, and County Auctions of Wooler, who were restricted from sourcing stock from their traditional areas in Scotland because it was another franchise area, the tensions led to them withdrawing from EASE. At the same time the auctioneers who had their interest in electronic marketing excited by ANM but were unwilling to join EASE because of the terms or because their local franchise was awarded to someone else, looked around to develop an equivalent system. The two networks of

auctioneers which coalesced developed BEACON and LEAN, both of which were jointly owned by networks of auctioneers rather than franchised and both of which placed fewer restrictions on the freedom of members to source stock by not tying auctioneers to a defined area. County similarly developed their own EASE-like system DIRECT, which they had ownership of and therefore freedom to operate wherever they wanted. John Lind who had been ANM chief executive left ANM to set up APEX United Kingdom, taking the rights to the NEMI system also operated by OLEX in Canada, licensing it for livestock sales to Montrose Market for the whole of Scotland and to APEX Ltd., an offshoot of Rugby Market for England. APEX Ltd took on Colin Young and Frank Yeo from the EASE network to manage their stock sourcing operations in the north and south of England respectively. APEX therefore drew on the expertise of existing electronic market operators, but operated through two franchisees covering very large areas to minimise the tension found in the EASE network between an auctioneers live market and the electronic market in competing for stock. From this it is seen that there was a danger in franchising of negative motivation by franchisees who were in part buying a local monopoly, which limited the opportunities to develop the market by constraining aggressive franchisees to defined areas. By linking franchises or network membership to existing markets the electronic markets gained legitimacy and access to expertise but it limited the motivation to expand the market because they feared it would displace their physical auction sales. Existing market operators had the advantage that they could use existing market staff taken off other duties to carry out livestock descriptions, whereas APEX, which operated fieldsmen across England, had to use more expensive full-time assessors.

Both the Superior video auction and the CALM auction system also enrolled a network of sellers by enrolling existing intermediaries who could exploit their links to farmers.

### ***Enrolling Buyers***

While the enrolment of existing intermediaries provided a route to the enrolment of a cohort of producers, the most difficult group to enrol into an electronic market network were buyers. While the analyses of electronic markets emphasised the benefits of transparent markets (for example Henderson, 1984; Rickards et al, 1983) , buyers benefit from the information asymmetry in opaque markets and therefore may resist the openness of electronic markets. Organised resistance was seen against the initial EMA cull cow auctions, the CALM slaughter cattle auctions and the proposals to set up electronic fish markets in the United Kingdom. Elsewhere, including the United Kingdom grain auctions and the South African markets, the opposition was more passive, with an unwillingness to bid on the electronic system at levels which might set the price for all a buyer's direct trades.

### *Systems In Other Markets*

Following the adoption of an electronic market in a sector it can be argued that opportunities exist to apply the technology for the trading of other commodities. While all the electronic market systems studied were developed with particular commodities in mind, to a large extent an electronic market is a generic technology suitable with minor modifications for selling other commodities, using the same hardware and auction mechanism. This could be achieved through either licensing the systems to intermediaries involved in the markets or diversifying themselves. APEX UK, EASE, BEACON and LEAN followed strategies of applying their existing software themselves in markets which they viewed as analogous to their existing agriculture produce markets, notably grain and timber. The limited success of these attempts to diversify suggest that their understanding of these markets was less clear than initially believed. The more successful diversifications enrolled personnel with the expertise and social contacts to ensure that buyers and sellers were willing to use the electronic market system. Of the four UK auctions which sought to diversify, APEX UK has been the most successful, following their strategy of being purely service providers, operating auctions in eggs and milk for existing egg and milk marketing bodies. The systems which have tried to be more directly involved in the trading of other commodities have found gaining user acceptance more difficult than expected. Of these BEACON has been most successful by building links with existing timber dealers and taking on an experienced grain buyer to co-ordinate their grain sales. Similarly, for EASE's establishment of EASIGOE to auction redundant oil equipment, they recruited expertise from the oil industry to use the agricultural software, slightly adapted, to operate the auction on their behalf. In contrast, attempts to diversify into timber sales by EASE and LEAN were unsuccessful because sellers and buyers were suspicious of a new entrant to the industry.

The second strategy was to seek to sell the rights to operate the systems in foreign markets, which was followed by CALM, APEX/NEMI, Tengill and OLEX. CALM licensed their system for use in New Zealand and sought to sell the system in South Africa and Argentina. OLEX sold their system to ANM to create EASE, while NEMI/APEX sold the rights to their software to AGMEX in South Africa, RSF adapted their Tengill system for use in Massachusetts. In each case, compared to the market assessment exercises carried by Schelfhout with Highland Harbours and Scottish Milk, there was limited adaptation of the software to suit local conditions. The view was that selling the rights to these systems would be a useful source of additional revenue, but that it had not been a factor in the decision to develop the system. DIRECT, LEAN and BEACON had not explored the possibility of exporting their systems. The sale of the APEX/NEMI software to South Africa demonstrates the low importance of technology for system operators. Vleissentraal, the operators of AGMEX, were put in contact with APEX through the MLC. They were not put in contact with DIRECT, LEAN or BEACON, who all operated more technologically

advanced systems. They selected APEX as the system they wanted to buy in a comparison with the more complex and advanced CALM system. The crudeness of the APEX system was outweighed by its lower purchase price and operating costs and the limited requirements it placed on both users, needing only dumb terminals, and the operator, being able to run the auction using a standard IBM personal computer.

The involvement of existing market operators in the diversification of electronic markets into different commodities or geographical areas implies that the developers of the systems believed that the operation of an electronic market was dependent upon a knowledge of the market in which it was to operate and, unsurprisingly for firms which used their existing market position as the competitive advantage which they had over potential third-party entrants, a belief that an existing market intermediary had to be involved to legitimise the electronic market.

### *Stasis in System Development*

During the twenty years since the inauguration of Telcot, the cost of information technology has fallen and its capability increased. It is striking when observing the systems in use that once installed there is little evidence of incremental development: in particular taking full use of the processing power of personal computers and faster networks. This is seen most graphically in the NEMI auction continuing to use dumb print terminals rather than personal computers. The reasons for this stasis appear to be a combination of network effects, both the technical lock-in to solutions in network systems and barriers to co-ordinating the development of the technology across networks of users. An electronic market system includes the software and hardware in the host and in the dispersed community of users, so to upgrade the functionality of the system it is either necessary to ensure upward compatibility, in which users of the improved system can use their systems alongside users with non-upgraded users, or the entire community shifts to an improved system. The barrier in electronic markets to a path of overlapping system upgrades is that the functionality of the system is embedded in the message standards used to communicate between the central host and satellite users. A change that allows upward compatibility would either need to leave the messages unchanged and be built into the host or client software, or lead to the operation of two message standards in parallel. In the United Kingdom livestock systems, the moves towards clearer system presentation in the BEACON, LEAN and DIRECT systems compared to the EASE system, from which they were derived, could have been achieved through software on a client computer. However, it was not felt by APEX or EASE that these improvements justified the expense of developing solutions which required software running at the client, preferring to stay with the OLEX and NEMI systems which only required dumb terminals. Wider changes to the systems, for example the transfer of graphical images, require the software to be upgraded at each end and the capacity of data transmission to be increased. This

requires the co-ordination of a fundamental change in the system. The co-ordination of these changes makes the incremental development of existing electronic market systems difficult. While SCS and Nieaf-Smitt were developing their systems offered to users to make use of Windows, ISDN and more powerful user computers, the systems rarely were upgraded in use, rather the improvements were offered as elements in new systems. In all the other systems the model was to start with a survey of existing systems, identify their strengths and weaknesses and design systems in which the current technology was used to overcome weaknesses in current systems, as seen in the incremental improvements made to NEMA with NEMI, and the improvements over EASE made by DIRECT, BEACON and DIRECT.

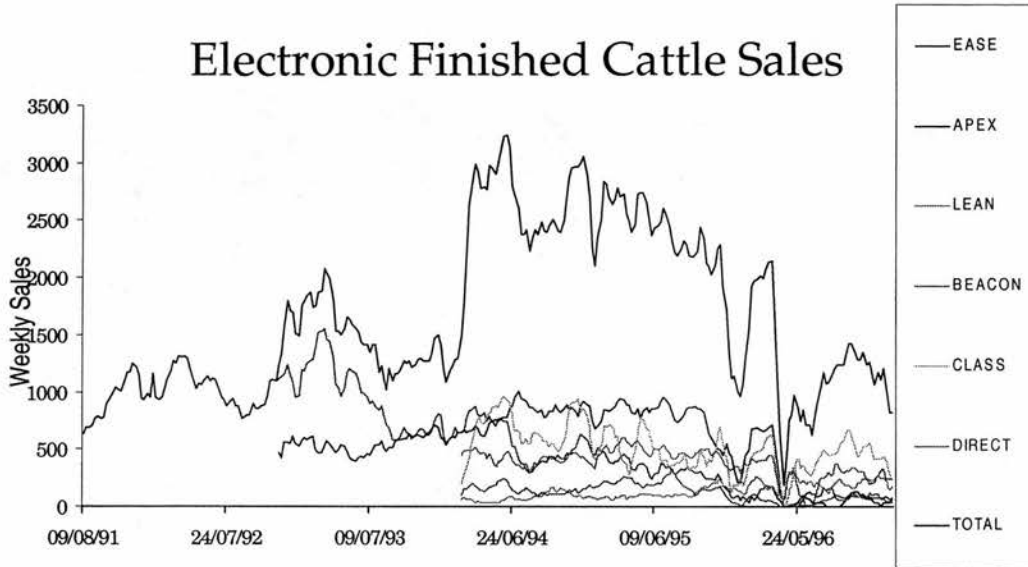
The ownership of systems by existing intermediaries also inhibited their further development. First, it restricted their access to the expertise necessary to develop their systems, both in terms of human resources and an awareness of the potential for technological innovation to improve the operation of their markets. Second, the motivation for developing the markets was based on a detailed understanding of their market, leaving them without the expertise for adapting their electronic market systems for operators in other sectors. In the cases of NEMA, CATTLEX, LEAN, BEACON, DIRECT, BODI and CASS specialist software companies were contracted to develop the systems, which while cementing the instigating intermediaries' ownership rights over the systems, limited their ability to maintain the systems. Except in the case of BEACON, where a partnership with British Telecommunications was being exploited to investigate the possible use of ISDN and graphics through the active interest of R Pearce of Stephenson's of York, the organisations which had developed the systems appeared to have viewed the technology as relatively stable, in that a system once developed would not require further development.

### **Dissolution**

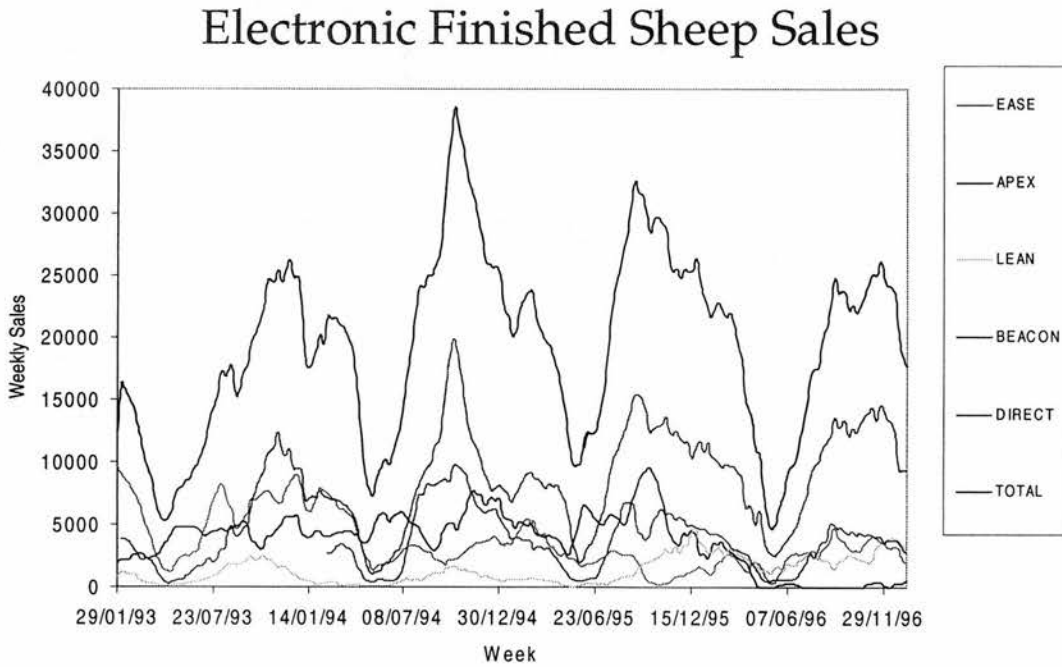
While Callon's model includes the conception and adoption phases, in the North American, United Kingdom and Australian livestock systems the adoption phase was followed by a dissolution phase during which the networks contracted. Following Callon, this phase is characterised by a failure to stabilise the translated entities. This dissolution phase was seen most clearly during the research within the competing United Kingdom livestock systems. The pattern of electronic livestock sales for sheep and cattle in the United Kingdom on the electronic systems shows a history of switching fortunes between the competing systems, with a slow but progressive decline from 1995. Whereas in 1990 the rush by auctioneers to join electronic marketing systems demonstrated their expectation that electronic marketing would replace direct

selling, due to the greater competition in the market, and physical selling because of the lower marketing costs, by 1998 electronic livestock selling had become a small niche in overall livestock sales.

**Table 14: Electronic Cattle Sales**



**Table 15: Electronic Sheep Sales**



In all the United Kingdom livestock systems the operators expected that the trading levels would grow as buyers and sellers recognised the benefits of selling electronically over live auctions or direct selling. In reality the systems rapidly hit stable trading volumes, which then tended to fall back slowly. The key factor identified by operators to explain this decline was the reluctance of buyers to bid on their systems. In part this buyer resistance was believed to be due to their investment in networks of buyers and agents involved in direct procurement and partly their fear that transparent price reporting would increase prices for their directly procured stock. The implication that many buyers would be marginal users of electronic markets, using them to source small numbers to balance killing schedules or to source stock when their own network of buyers was short of stock, was suggested by the survey of buyers using EASE by Christie et al. (1991). The unwillingness of buyers to bid above the prices they paid for direct procurement reduced the attractiveness of electronic auctions for sellers. It was claimed by the lamb buyer interviewed that electronic markets for sheep have been relatively more successful than those for cattle because of the relatively lower commitment of lamb abattoirs to maintain a network of buyers.

The system operators believed that the numbers of stock sourced on each of the competing systems was influenced by the number of fieldsmen actively sourcing stock and the marketing efforts of the operators. The overall decline in the numbers of stock traded is linked to the cutting back by operators of the number of fieldsmen employed and the switch from full-time to part-time fieldsmen as the operators sought to reduce the overheads of system operation as the systems failed to meet the expected volumes. APEX Ltd was seen by other operators as the most successful of the systems, but this success in terms of volumes was achieved by enrolling experienced managers who put a larger number of fieldsmen into the field than the other systems, which eventually bankrupted the company. It was believed by operators that the relative shares of the market were volatile due to operators and fieldsmen switching between systems. EASE's position declined as franchisees withdrew from electronic selling (TEAM), set-up their own systems (County Auctions of Wooler) or joined rival systems (F Yeo, C. Young and the mass defection to LEAN in 1996). The dropping out of three fieldsmen to form Borders Livestock Exchange in 1995 affected DIRECT, while APEX, through Yeo and Young, took fieldsmen from EASE, and in the case of Yeo, lost them to AGVISION.

The auctions also suffered due to farmers defecting from the electronic systems because once a buyer has bought stock of an acceptable standard from a farm, they could approach that farm directly in future to source stock. It was believed that producers who sold on the electronic systems learnt which abattoirs were interested in their type of stock, so when they had more similar stock to sell they could contact the abattoir directly, by-passing the market. Similarly, abattoir buyers using the systems learnt which farmers were

producing stock meeting their needs, even if they did not buy it themselves, and could then approach the farm directly to canvass for stock. As explained by Harvey of Scotbeef, for abattoirs direct buying is based on an identification of producers of consistent quality livestock, not a random search up farm lanes. For an abattoir to buy stock which has been advertised in an electronic auction catalogue prior to the auction is equivalent to the forestalling which plagued medieval fairs, when buyers would illegally intercept drovers bringing their stock to the fair and buy them without paying the taxes levied in the fair. It was suspected that the widespread dissemination of price information by electronic systems reduced the risks for producers trading directly as they could use the information from electronic auctions to ensure that they were being paid a "fair" price, but this was a free-rider problem for investors in electronic systems, with traders using the price information without paying for it. This risk was recognised by Henderson et al. (1976) who proposed that the free rider problem could be overcome by making sale through electronic systems compulsory. The creation of statutory marketing channels has been for many years a response to the problems of weak producers faced by thin oligopsony markets, as seen in the Australian wool industry, the United Kingdom potato and milk industries and Canadian hogs, so the use of compulsion to ensure that the investment in electronic markets could be justified and free-rider problems avoided was not unrealistic. However, by the eighties the trend in Europe, North America and Australia was away from marketing intervention.

It was also believed that the electronic trading communities shed participants because of the actions of assessors. It was accepted by the operators that the expertise of assessors was crucial for the operation of electronic markets, but this centrality placed them in a position to undermine the systems. Agents employed to source and assess stock built up expertise about the detailed requirements of abattoirs and producers' reputations, and agents who were accurate assessors built up reputations with abattoirs. When a farmer approached the agent with a lot for sale electronically, and the agent knew of a customer for that stock, it was believed to be tempting for the agent to either buy the stock and sell them on or broker a deal for the farmer, bypassing the system. There was evidence of this happening both with individual agents, who as self-employed assessors had limited loyalty to the system they were nominally procuring for, and also by the franchisees to the electronic auctions, who realised that their commission would be higher if they did not have to split the commission with the system owners. This forestalling was seen as a major cause in the collapse of the CLASS satellite auction system, but was experienced in the other United Kingdom systems and by CALM in Australia.

The retailers in developing their own proprietary farm assurance schemes have also created a barrier to stabilising electronic auction networks. Early justifications for electronic auctions were based on the use of the electronic system to provide an anonymous market as close to "perfect competition" as possible.

Ostensibly for welfare reasons, the major United Kingdom retailers have introduced their own proprietary schemes for certifying the stock rearing regimes on farms, in addition to the government supported national schemes. The effect of proprietary farm assurance is that stock being bought by an abattoir for a retailer can only be bought from a small pool of certified farms. The abattoir will source stock directly from these farms for their customer, with a premium being paid for the greater confidence that the retailer can have over the quality of stock reared following a specified regime to meet the customer's specification, but this is no longer the anonymous market on which the economic justification for electronic markets was originally based. Again the price information provided by electronic auctions provides a guide for setting prices in direct sales.

### **The Failure of Progress Through Information Technology**

The history of the development of the systems studied questions the rhetoric behind visions of the inexorable use of IT to automate existing social processes. In particular the experience of the electronic trading communities questions the assumptions of Venkatraman's Business Network Redesign (1991), in which developers of information technology are exhorted to use it to restructure radically processes across a network of organisations. While the rhetoric of BNR and strategic information systems has been influential in gaining commitment to electronic markets, the empirical evidence shows that its emphasis on clean sheet analysis and the ignoring of existing processes leads to over-ambitious visions being built into the systems. In practice the systems studied did not fit in with this radical model, displaying two forms of conservatism: first, a tendency for the systems to emulate existing systems, and second, a pattern of systems maintaining existing institutional structures within the industries. The INFOMAR project, funded by the European Commission, may be seen as exemplary of a business network redesign approach. However this project has had to adapt when the difficulty of launching a pan-European fish market by-passing existing markets was realised by the participants, who are redirecting the project to operate through existing fish markets, including the enrolling of IJmuiden and Grimsby into their network. The INFOMAR project network was oblivious to the experience of the USDA and CALM projects to highlight the barriers to developing a radical vision for the re-engineering of a well-established industry with deeply embedded links and initially had no involvement from existing auctions. In opposition to this approach to developing a pan-European fish market can be contrasted Zeebrugge's PEFA project, in which the project is an incremental development of the existing fish market, with a plan to progressively enrol existing markets into the network. History would suggest that Zeebrugge is more likely to be successful because it is driven by an existing intermediary.

One attempt to follow the BNR paradigm was Istel's project to introduce electronic commerce into the livestock industry, passing beyond the replacing of existing auctions by electronic auctions to include the tracking of cattle from birth to supermarket. Istel's project failed and the other two livestock projects with radical visions for improving processes within auctions, CATTLEX in Texas and CALM in Australia, respectively failed and were far less successful than expected even though the designs of the systems were based upon theoretical models for improving the auction process and surveys of the attitudes of potential users. The other livestock systems covered were less radical, building upon existing organisational structures and largely emulating existing auction mechanisms, although changing the nature of those relationships by allowing remote buying. This supports Graham et al.'s (1996) conclusion that while the concept of BNR appears attractive, the complexity of co-ordinating change across a network of organisations makes it very difficult to achieve. Indeed, the most successful electronic markets studied were the electronic Dutch auctions where the initial introduction of technology into the markets was purely an automation of the "shout" auction, followed by progressive incremental changes to create networks of auctions open to remote buyers. While the dominant pattern by which electronic markets form is through incremental change it is not claimed that the proponents of the systems lacked either a strategy for the systems' development or a vision of how the systems would affect trading. Rather, as Collingridge (1992) noted in studying large scale technology projects, an incremental approach provides the flexibility to adapt the strategy and adjust the speed of change in response to circumstances. The electronic livestock systems, being developed in parallel to existing markets by firms with limited resources, provided less flexibility for adaptation than the incremental pattern of development seen in the Dutch auctions.

### **Evolution of Electronic Markets**

While the analysis of the economics of information in markets of Stigler (1961) and Bakos (1991) suggests that the greatest resistance to electronic markets will come from sellers due to the lower search costs leading to lower prices, in practice the resistance has been found to be greatest amongst buyers. The explanation of this anomaly is that Bakos' analysis neglects that buyers are almost invariably following mixed buying policies, with some stock bought in direct negotiation with producers and other stock bought in auctions, both live and electronic. Market reporting in live markets is translucent rather than transparent, with uncertainty remaining about the actual quality, and in many cases quantity, of the stock sold for a given price. The need for detailed reliable descriptions and the facility for observers to monitor the market as it happens mean that electronic markets are more transparent than live markets. It was found by system operators that buyers are unwilling to bid to levels on the electronic auction which will affect their direct negotiations with producers. In many of the electronic auctions this effect is exacerbated by the electronic

systems providing price information in a form ideal for supporting direct deals, with the buyers and producers introduced to each other through the electronic auction then using current electronic prices to set the prices in direct trades and saving the auction commission. The electronic market therefore suffers from the wide dissemination of price information encouraging free riders. For buyers, producers are not an anonymous mass of undifferentiated sources of product; rather, buyers tend to develop close links with a core of suppliers, thereby limiting search costs, supplemented by a range of more peripheral suppliers they can call on when needed. In using the electronic auctions, buyers are trading on the reputation of the assessor or system operator rather than trading blindly. Analyses which assumed that there would be anonymous trading in electronic markets were undermined by the embeddedness of the social relations within the existing markets upon which the electronic markets were overlaid and the electronic markets creating new linkages between buyers and sellers.

The evolutionary argument that efficient technologies will eventually displace less efficient ones is even more suspect when applied to a network technology than when applied to a discrete technology. While evolutionary theorists argue that less efficient discrete technologies may become dominant, predicting the paths along which technologies embedded in social networks develop is more complex because of the difficulty of ranking technologies. The importance of social change in implementing electronic markets makes the unpredictability of social evolution more relevant to understanding the evolution of electronic markets than the evolution of technological artefacts. While there are legion examples of technologies which converge to a global standard, in social systems the lack of evidence for evolution towards a global political or religious system is taken for granted. In these social systems the difficulty for agents in making a calculation of utility and the embeddedness of existing relations preclude an evolutionary convergence. The diversity in national systems of agricultural marketing demonstrates the resistance to convergence spatially in trading methods due to the embeddedness of social relationships in markets, and this embeddedness must also be overcome for convergence to come about through the introduction of technologically driven changes.

If the social influences on the formation of electronic market overwhelm the technical, one would expect to see distinctive local systems emerging in different cultural milieu. If evolutionary models without irreversibility were valid for the analysis of social processes the structure of agricultural markets throughout the world and the processes used within them would converge. While an evolutionary economist could argue that variety in livestock markets is due to exogenous differences in climate and geography, this cannot be argued so strongly in the fishing industry, where the procedures and structures around the world have evolved into enormous diversity from essentially the same starting point. Rather

than electronic commerce being a force to bring about convergence, the need to enrol a viable trading community in the system make it a potential mechanism to entrench existing structures.

Early accounts of electronic markets assumed that the existing live markets approximated to theoretical markets, in which buyers and sellers trade anonymously in transient transactions, and that electronic markets, with their wider geographical spread and lack of contact in a physical location, would even more closely represent the idealised model of perfect competition in commodity markets. However, it is clear that in both traditional fish and livestock markets the relationships between buyers and sellers, including trust and reputation, influence behaviour. In moving towards an electronic market it is not the case that this social capital becomes less important. Rather, due to the need to trust the description of the stock on offer, the trust between buyer and auctioneer/assessor and the reputation of sellers paradoxically becomes more important. The technology of electronic auctions has been seen to be less important in explaining the success of electronic market systems than the enrolling of buyers and sellers. The development of electronic markets may therefore be seen more usefully in terms of social rather than technological change.

## **9. Conclusion: The Construction a Network Technology**

### *Chapter 9*

The Construction of a Network Technology

### **The Social Analysis of Electronic Commerce**

This thesis has attempted to use Callon's sociology of translation and actor network theory to analyse the formation of electronic auction systems, including both the technological artefacts and the social network. As discussed in chapter 2, the social analysis of technology is methodologically diverse, with debates concerning the ontological status of technological artefacts and the epistemological status of statements about technology. This final chapter draws lessons from the analysis of the electronic auction cases covered in chapters 4,5,6 and 7 for these debates, specifically the rhetorical role of discourse in the development of the social network related to technology and the advantages of an intersubjectivist phenomenological approach to overcome weaknesses in epistemological relativist, constructivist and Actor Network Theory methodologies for the analysis of the development of technologies.

#### ***The Rhetorical Status of Discourse***

For Williams and Edge (1996) the social shaping approach to the analysis of technology is described as being antithetical to economic determinism, in which a simple cost/benefit calculus drives technological development towards a pre-ordained solution. However, for evolutionary theorists, including Dosi (1983), in accepting the notion of technological trajectories there is a risk of adopting a weaker social determinism, in which consensus is seen as irreversible closure and the trajectory is given but subject to deflection by social forces. There is a danger that the development of electronic commerce becomes seen as inevitable, driven by the capability of information technology and its apparent economic advantages. The focus in retrospective accounts of the development of systems by both actors in the process and external observers on successful implementations, overlooking failures, creates the impression that technologies have evolved along almost predetermined trajectories. The history of electronic markets demonstrates that, despite the convictions of early proponents, it is not inevitable that electronic trading will displace orthodox trading and that when it does develop, the complexity of the social structures it is built on to and the diverse pressures shaping it mean that it will not follow a predictable trajectory.

#### ***The Failure of Economic Analysis***

It was found in the electronic auction systems studied that actors could use the theoretical insights into markets and information costs found within the economics literature to enrol other actors, shape the system to provide them with benefits and assess their investment. However, MacKenzie has argued (1990) that instead of being grounded in some transcendent reality, accountancy and the assessment of technologies are themselves socially shaped, with the criteria used and the method of assessment being influenced by deeper social forces. In the case of electronic markets this social shaping of assessment goes beyond

MacKenzie's ethnoaccountancy: the complexity of assessing the number of buyers, sellers and intermediaries who would use a system and the prices that would be achieved on the system are so imponderable that the developers invested in this technology on the basis of an act of faith. In this context, seeing the system *work* elsewhere is the dominant rationalisation. When a detailed analysis was undertaken for the CALM system in Australia it appears to have been undertaken primarily to enrol government support. The inherent bias of this analysis was subsequently exposed by the failure of the system to become financially independent as predicted. The USDA pilot systems were each influenced by academic agricultural economists and all failed, suggesting that a theorised approach to the design of the systems led to them being too dissonant from the social networks that they were introduced into. While general economic arguments were important for enrolling support for electronic markets, they were found to be invalid in practice.

### *The Interaction of Information Technology and Agricultural Economics Discourses*

Both the information technology and agricultural economics combined a generic foundation, the falling cost of information technology and the economics of markets, which had a supportable claim to be true, with a prescriptive element, the strategic use of information technology and the desirability of perfect competition. The papers, reports and presentations arguing for electronic markets could unite these two discourses. The strength of this merged discourse was amplified by being able to describe examples of operational electronic markets and mediate them through the information technology and agricultural economics discourses. While the United States and Australian governments were both influenced by the economic analyses produced by academics, for market operators the most significant influence on their decision to develop or join systems came from awareness of accounts, whether in journals in presentations, which described systems operating successfully. Descriptions of electronic market systems which claimed that they were viable were highly influential in shaping electronic market systems, both for the initiators and for enrolling actors into the networks. While the economics literature could provide a theoretical argument for their viability, real world examples both provided corroboration of these claims and also gave a detailed guide about how to structure the electronic market. As the number of electronic markets increased, the importance of examples of existing markets increased and the importance of the economic analysis declined in the process of enrolling potential users.

However, the descriptions of electronic markets, both in academic journals and in trade journals, were biased towards describing perceived successes, such as Telcot, and ignoring the failures. The launch of EASE in the United Kingdom triggered articles by journalists and academic writers, but its subsequent decline was neglected. A large part of this bias was due to the information being disseminated by actors

using cases to enrol others or by academics and journalists who found describing “successes” both easier to gain access to and more interesting for their readers. This bias was demonstrated by the weight of papers which were published by academics involved in the USDA funded pilots describing the systems they had developed but who did not publish follow-up papers explaining why these systems failed to deliver the expected benefits and why their earlier papers were misleading.

By combining the inexorability of IT diffusion and the economic analysis of markets, supplemented by examples of operating electronic markets and linking it to the strategic needs of the audience, a powerful case could be made to enrol resources to the inchoate electronic markets. This was most clearly demonstrated when ANM sought to enrol franchisees for EASE in the United Kingdom, arguing that the lower costs apparent technological progress and operation of the electronic market in Canada jointly provided that electronic marketing would be successful in Britain. The success of this argument was demonstrated by the rush of firms seeking franchises, which led to the emergence of two further competing systems in the United Kingdom.

The failure of the livestock auction systems in Europe, North America and Australia, as perceived by the proposers and developers of the systems, leads a questioning of the validity of the economic analyses of Bakos (1991) and Malone et al (1987). Their positivist economic analyses may therefore, adopting the critical economics perspective of McCloskey (1986; 1994), be seen as rhetorical, using desocialised conceptions of the market and information technology to enrol interest in the potential for electronic markets. The problem posed by the status of the *economic* in social analysis of technology in general and the “broad church” social shaping approach of Williams and Edge (1996) in particular was identified in chapter 2. The economic arguments of electronic market proponents embody a claim that their conceptions of market price, market depth *et cetera* represent a transcendental reality upon which the social elements of markets are built, but it is this claim to represent objective reality which provides them with their rhetorical force.

### ***Electronic Markets: A Socially Shaped Technology?***

This study of electronic markets demonstrates the impossibility for advocates of a network technology of knowing whether it will be used and, if used, how it will be used. While this uncertainty exists for discrete technologies, it is greater for network technologies because the developer does not only have to assess whether the technology will have utility for isolated users, the utility for users depends on the behaviour of other users, so the assessment by potential users is influenced by their expectations of the behaviour of other users. This uncertainty is particularly severe in assessing proposed electronic markets because the

potential user community is heterogeneous, with the actions of sellers influenced by buyers and vice versa, and so on in a regression.

In the formation of electronic markets there have been two influential discourses: a normative discourse concerning the impact of Information Technology on organisations, and a discourse based around the economic analysis of markets. While both of these discourses claims to provide a true analysis, selectivity of evidence and their fundamental assumptions lead to partiality. The cases discussed in this thesis demonstrate that it was the interplay of these discourses rather than the negotiation between actors which has been the underlying force shaping the formation of electronic markets. While the IT and economic discourses were a catalyst for making actors realise that an electronic market could be built in a particular sector, the same discourses were used by them to draw the other actors in to build the system and beyond that the trading community.

### *The Archaeology of Social Networks*

An insight provided by the network approach used in this study to the analysis of technologies requiring the construction of complex networks of heterogeneous users is the realisation that the need to build upon the existing constructed realities of actors limits the feasibility of radical social change. While Malone et al. (1987) saw industries as clean slates where network technologies could enable radical structural change, in practice they are palimpsests, with the innovation being shaped by the networks of social relationships on which it is overlaid. Network systems may appear to offer an opportunity for third-parties with technical expertise to displace existing market structures, but they lack the industry expertise and social contacts to achieve this easily. Where the existing member of the market initiating the innovation lacks the resources to develop it unilaterally and the strength to impose it on users, it must build inter-organisational conception and adoption networks. The dominant approach to network building observed was simplification: exploiting the embeddedness of existing social relationships (Granovetter, 1985), utilising existing components and emulating existing processes. This reliance on existing elements and relationships limits the potential for the innovation to restructure the industry because actors are unwilling to be enrolled if there is a fear of detrimental effects. While this process of simplification reduces the uncertainty for enrolled actors, it is still impossible for them to determine completely during the conception phase how the adoption network will evolve. With the innovation in operation the relationships between actors evolve as they learn how the technology can be exploited. Therefore, while naive predictions for electronic commerce forecast major impacts, the requirement that the systems are overlaid on existing social networks reduces the planned impacts of electronic commerce systems, but the complexity of the networks on which they are overlaid make it impossible for developers to determine how they will be used.

### **The use of ANT for analysing network innovations**

Callon's concept of translation provides a plausible account of the building of the systems by the instigators. However, in analysing these cases following Callon's methodology the use of a social network approach becomes problematic. The instigators of the systems proposed electronic markets as a solution to the farmers' need for a competitive market, the abattoir buyers' need for a direct sourcing, the livestock's need to be slaughtered single network incorporating all the involved actors<sup>46</sup>. As Grint and Woolgar (1997, p 30) noted, this raises the question of which account is to be taken as definitive. In the cases described in this paper all the actors interviewed saw themselves as part of a network involved in electronic markets and could narrate how they developed, but individuals had widely diverse interpretations of their networks. For the auctioneers the technology was at the heart of the network, leading to them gaining ownership of the technology in each case, but for the farmer the technology was never seen and those interviewed saw the fieldsmen as pivotal. The abattoir buyers saw electronic markets as an addition to their existing networks of agents buying directly from farms or in live markets. The networks were unstable because of the differing perceptions in the links between auctioneers and fieldsmen. The auctioneers recognised the importance of the fieldsmen, both in terms of their ability to grade stock and their ability to persuade farmers to sell electronically, but the fieldsmen did not need the auctioneers, being able to defect when they achieved a reputation with abattoirs and farmers, taking their links to farmers and abattoirs with them. Each actor had their own idiosyncratic conception of the market, which could also include abstract concepts, such as "housewife", "competition" and "animal welfare", and where the boundaries of the network lay. Rather than a single network there are as many networks as there are actors to construct them. If the reality of the electronic market is a personal construction for each actor it becomes difficult to maintain Callon's symmetrical treatment of human and non-human actors alike. It is still possible to view the markets as socially constructed due to the tendency of social actors' views of reality to converge intersubjectively through experience and interaction, but it is impossible to state categorically what the market is.

Callon's approach is not constructivist because to maintain symmetry between human and non-human actors it is impossible to treat human actors subjectively. In the discussion of the case studies in chapters 4,5,6 and 7 the analysis is of how human actors formed a network which included non-human entities. While the enrolment of sheep, cattle and fish was necessary for the electronic market systems to become

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<sup>46</sup> This analysis is implicit in his conception of *irreversibility* in networks (Callon, 1991) and is explicit in a discussion by Callon of ticket barrier technology (Callon, 1993).

operational, their refusal to be interviewed unfortunately led to them being viewed through the interpretations of human actors. Similarly, while Callon (1986) professes a symmetrical treatment of scientists and scallops, it is implied that the scallops were less co-operative to Callon's research than the scientists, leaving him to impute the scallops' involvement from the scientists' accounts. Callon's actor networks may therefore be seen as social-technical fields formed intersubjectively by the human actors.

Habermas (1987) splits the social universe between the intersubjectively negotiated *lifeworld* and the impersonal system level, comprising institutions and formal organisation. Habermas (1987) shares with Foucault (1975, 1984) an interest in how subjectivity is created through discourse and communication. Foucault's approach, as exemplified by his discussion of Bentham's panopticon (Foucault, 1979, p 200), in so far as it addresses technology as an embodiment of knowledge, treats technology as creating subjectivity in a disempowered subject, therefore aligning with a view of technology which sees it as having impacts on subjects. While Foucault's model of subject formation has been related to technology (Zuboff, 1989; Silverstone & Mansell, 1996), Habermas's intersubjective theory of communicative action has been used by Habermas to analyse the formation of bureaucratic institutions and the state (Habermas, 1996). While Habermas's exposition of his theory of communicative action (Habermas, 1987) focuses on how the formation of social institutions creates systems which remove aspects of social life from the negotiable lifeworld and translates them into the un-negotiable background of social reality, the same process can be seen in the creation of a technology. While social analysts of technology (Grint & Woolgar, 1997; Fleck, 1994) have criticised essentialist analyses of technology, arguing that technologies can be interpreted and used in diverse ways, this neglects the constraints on people's beliefs about what any technological artefact is capable of doing. As with social institutions, intersubjective beliefs about the capabilities of technology remove aspects of social life from the negotiable lifeworld.

Because Habermas's approach is intersubjective it is implicitly open to a social network interpretation. In this interpretation the process of network building may be seen as the intersubjective identification of a need (*problematization* in Callon's terminology). This consensus is negotiated rhetorically using texts, interpersonal communication and exemplars. The network building then proceeds by increasing the size of the community by enrolling further members and systematising elements as either institutions, for example in the case of electronic auctions creating institutions to own the rights to software, or as technological artefacts. The movement of elements from the fluid negotiable lifeworld into systems corresponds to closure in technological debates (Bijker, 1992).

An intersubjective phenomenality derived from Habermas is a broader basis for the analysis of technology seamlessly from initiation in small specialist communities to its use in large user communities than constructivism. The constructivism in Science and Technology Studies (STS) has followed an epistemological bias from its roots in the philosophy of science (Jasanoff et al, 1995). However, while a focus on the debates about electronic markets provide insights into the conception phases of the systems in which the alternative options were being assessed and the system designs finalised, it provides little insight into the frequent failure of the social networks created to become stabilised. During the adoption phases a constructivist approach based on the more quotidian phenomenological constructivism of Berger and Luckman (1966) provides a greater insight into how the electronic systems failed to infiltrate the worlds of buyers and sellers. A Habermasian phenomenological approach is more valuable than epistemological approaches for analysing the social processes behind the development of technology because, as has been seen in the case studies, the uncertainties faced by actors involved at each stage were more related to whether a vision of the electronic market embodied in technological artefacts would become *real* to the other actors than to questions about the truth of competing claims and knowledge. Where Callon's ANT focuses on a negotiation between the interests of actors during translation, Habermas's theory of communicative action's enables the role discourses and rhetoric in the creation of the lifeworld to be uncovered and the roles of experts in legitimising systems, and thereby removing them from the arena of consensus negotiation, to be unmasked.

In conclusion, while the perspective that a technology is socially constructed was criticised in chapter 2, the case studies demonstrate that the electronic market systems studied were metaphorically constructed from existing components using rhetoric, exemplification and systematisation to achieve consensus and enrol subjects.

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