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The design and evaluation of an electronic simultaneous progressive slaughter cattle auction

Lynn Wesley Dippold
Iowa State University

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The design and evaluation of an electronic simultaneous progressive slaughter cattle auction

by

Lynn Wesley Dippold

A Thesis Submitted to the
Graduate Faculty in Partial Fulfillment of
The Requirements for the Degree of
MASTER OF SCIENCE

Department: Economics
Major: Agricultural Economics

Signatures have been redacted for privacy

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Ames, Iowa
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I. INTRODUCTION

A. Livestock Marketing Institutions in America: An Historical Perspective

Perhaps no word more accurately depicts the history of American livestock marketing institutions and price determination mechanisms than "change." Largely responsible for this on-going phenomenon has been the interaction of economic development forces with technological advancements. Since 1920, this interaction has been illustrated by producer dissatisfaction with terminal marketing and the advent of the motor truck, which has resulted in a continual shift to decentralized modes of livestock marketing. Despite this steadfast trend towards decentralized livestock marketing, one should not be disillusioned into believing that the future will be without continued institutional and price-mechanism change. Upon completion of a review of the historical changes in the structure of markets and marketing institutions, Wilcox et al. [31, p. 115] concluded that recent structure and institution developments represent only one point on the continuum of marketing change. Accordingly, Wilcox predicted economic and technological developments would provide the impetus for even more rapid and dramatic changes during the remainder of the Twentieth Century. [31, p. 115] To enable the reader to understand the potential for further changes in the institutions and mechanisms of price determination, it is necessary to review the highlights of livestock marketing development in America.
1. Pre-Twentieth Century livestock marketing institutions

At the time of Columbus's discovery of the New World in 1492, domestic meat animals did not inhabit the North American continent. Within a few years after the first permanent introduction of domestic meat-type livestock to the Eastern Coast of the North American continent at Jamestown in 1611 and at Plymouth Colony in 1624 [32, p. 4], domestic supplies of livestock were more than adequate [32, p. 5] for self-support. While the major livestock trade during the early stages of colonial development was in breeding stock, an abundant beef and pork supply in the Quaker Colony of Pennsylvania gave rise to an early export trade in beef and pork products. [32, p. 5]

Sale of livestock by auction in the pre-Revolutionary War Colonies was reported as early as 1676. [8, p. 3; 32, p. 6]

Developmental progress during the Eighteenth Century was highlighted by the establishment of the Brighton Market, near Boston, in 1756. [32, p. 6] This landmark achievement was the first public market of record in the Colonies. After the American Revolution, territorial expansion, demographic growth, industrial development, the advent of the steam engine, the consequential growth of the railroad, and the passage of the Homestead Act, were significant factors leading to the development of terminal markets.

Being strategically located, Chicago became the nation's leading hog packing center during the Civil War. [32, p. 18] While some cattle were killed in Chicago, a large portion of the Chicago receipts were shipped onward to slaughter points in the East. Typically, each railroad company with track converging in the Chicago vicinity operated its own stockyards for cattle shipped to Chicago on the railroad's tracks. [32, p. 19] Con-
sequently, communication of the prevailing price and supply conditions among the scattered yard locations in the Chicago area was nearly impossible. This problem was apparently resolved when the nine railroads serving Chicago consolidated their stockyard efforts with the opening of the Chicago Union Stockyards on Christmas Day, 1865. [32, p. 19] This successful venture marked the beginning of modern terminal livestock markets.¹

The Chicago opening was followed by the formation of terminal livestock markets in other U.S. cities.²

Despite the wide appeal of terminal markets, some producers soon realized that the system was not ideally suited for their needs. Prompted by prohibitive less-than-carload freight rates, concern over low livestock prices, and suspicion of unjustifiably wide dealer operating margins [32, p. 22], farmers began to search for new marketing methods. This search led to the establishment of the first local livestock-buying market on record at McGregor, Iowa in 1892. [10, p. 12; 32, p. 23] Although further local livestock-buying operations followed, the numbers remained small until the 1920's. [32, p. 23]

2. Twentieth Century livestock marketing institutions

During the Twentieth Century, the three major slaughter livestock marketing institutions and price determination mechanisms have been the terminal markets, the auction markets, and direct and country buying. [13, p.2]

¹Operation of the Chicago Union Stockyards continued until the stockyards were closed in August 1971. [16, p. 121]

The predominant Twentieth Century trend towards decentralized livestock marketing has been the result of the continued decline in terminal marketing and the steady rise in the use of direct and country buying channels. [9, p. 2; 13, p. 2] At the same time, the portion of the slaughter livestock sold through local auction markets has remained fairly stable since about 1940. [13, p. 3]

The trend towards decentralized livestock marketing has been in part caused by the development of hard-surfaced roads and the increased reliance on motor trucks for transporting livestock. [30, p. 2] Other contributing factors have included the federal government's intervention resulting in the establishment of a system of official grades and standards and a reliable market news service. [32, p. 24]

Some of the more apparent reasons for the popularity of direct and country buying among producers have been listed by Holder. [13, p. 8] These reasons include:

1. A price per hundredweight is established before the livestock leaves the feedlot. This enables the producer to refuse to sell if after partial negotiations the apparent exchange price is extremely low and thus not acceptable.

2. The determined exchange price is specifically established in terms of the producer's livestock and the producer's reputation for cattle quality. That is, because the producer's identity is known by the packer, direct and country marketing facilitates product differentiation to the extent a producer can establish a reputation for the production of quality cattle.

3. Direct sales and country buying eliminates most of the unnecessary shipping and handling costs associated with central assembly of cattle either before or after their sale.

Although the utilization of direct and country marketing methods have resulted in a reduction in livestock shrink and out-of-pocket producer ex-
penditures for commission fees, yardage, and livestock transportation, these marketing channels are not without defects. Among the most objectionable are the lack of competitive bidding on each producer's livestock and the producer's informational disadvantage which arises from shortage of pertinent marketing information available to the individual producer engaged in one-to-one negotiations with the packer representatives. [21a, p.5] In addition to a lack of negotiating power and market information, the producer's own personal negotiating skills may impair his attempts to receive the optimal exchange price for his cattle. Inadequate negotiating skills may in part be evidenced by a producer's failure to make several contacts with packer-buyers prior to sale of his cattle.

In recognition of the direct and country marketing method shortcomings, agricultural marketing economists and producers have drawn upon the recent advancements in electronic technology in an attempt to design new price determination mechanisms which enable centralized price determination in an attempt to eliminate the deficiencies inherent in country marketing while retaining the marketing cost savings of direct and country buying. The result has been numerous innovative electronic marketing system proposals and several operational exchanges which utilize telecommunication networks to link buyers and sellers with computers and other electronic devices in establishing transaction prices.

Several of the potential advantages of electronic trading in commodities over alternative modes have been identified by Forker. [9, p. 8]

These advantages include:

1. Cost of management time and transportation in finding buyers is lessened;
2. Need for central assembly of livestock, especially before sale, can be eliminated;

3. Number of potential buyers contacted or having an opportunity to bid on a lot is increased.

Thus, due to the shortcomings in the country and direct marketing methods and the developments in electronic technology which have made possible the advantages offered by electronic marketing systems, it appears that livestock marketing institutions are on the verge of further change.

B. The Problem: Need For An Improved Electronic Marketing System

The electronic marketing systems which have been proposed during the past seventeen years can be placed into one of three categories on the basis of the type of electronic exchange mechanism utilized. The three categories of electronic exchanges are as follows: telephone auctions, teletype auctions, and computerized exchanges.

Telephone auctions utilize the telephone conference call to establish communication among geographically separated bidders and the centralized auctioneer for the successive sale of consigned lots during the course of an ascending price auction. Telephone auctions have been successfully utilized in the sale of feeder pigs [22, p. 34] and slaughter lambs [24]. Attempts have also been made to utilize telephone auctions for the sale of slaughter hogs [22, p. 34] and eggs [23, p. 9].

Teletype auctions employ a teletype network to communicate between the geographically separated bidders and the electronic auctioneer in the successive sale of consigned lots during the course of a descending price auction. The Canadian provinces of Ontario, Manitoba, and Alberta have successfully utilized the teletype auction in the sale of slaughter hogs.
Furthermore, a proposal has been made for the establishment of a slaughter cattle teletype auction in the United States. [15]

The computerized exchanges utilize high-speed electronic computers to match producer offers with buyer bids. These exchanges permit producers and packers to enter bids and offers, as well as receive price information, through touch-tone telephones connected with the exchange computer's audioresponse unit. Computerized exchanges have been proposed for use in the sale of shell eggs [23], slaughter hogs [12], and feeder cattle [11].

While several of these electronic exchange proposals offer imaginative price determination mechanisms which permit centralized price determination without centralized livestock assembly, all such proposals have been characterized by imperfections. The major weaknesses in the prior proposals include erratic price fluctuations between lots, lack of market-determined premium-discount schedules for carcass weight and grades, and the failure to provide for more than one trading basis. In addition, the exchanges in each of the three prior proposal categories make it difficult for individual bidders to perceive the willingness of buyers to buy a particular lot and their willingness to buy comparable lots. This deficiency not only makes development of bidding strategies difficult, but also causes unwarranted interlot price fluctuation and inefficient exchange outcomes.

Furthermore, some telephone and teletype auction proposals have undesirably required that producers deliver their livestock to an assembly yard. Required presale livestock assembly may cause unnecessary facility and handling costs, cross-hauling of livestock, uneven delivery of cattle at packer plants, and increased costs of refusing low packer bids.
A further defect in electronic exchange proposals, compulsory producer participation, has arisen from concern over obtaining and maintaining sufficient trading volume to make the exchange financially successful and to avoid the free-rider problem.

After a study of the weaknesses in prior electronic marketing system proposals, Forker concluded that the previous electronic marketing system proposals have not fully nor adequately exploited modern electronic and computer technology. [9, p. 2] In view of this conclusion and the aforementioned imperfections in previous electronic exchange designs, it is apparent that further research and development in the area of electronic livestock marketing systems is needed.

C. Objectives and Scope of This Study

After a preliminary investigation into the weaknesses in previous electronic exchange proposals and the unutilized electronic and computer technology, the following two objectives for this study were formulated:

1. To design an electronic slaughter cattle exchange for marketing cattle fed in Iowa which eliminates the deficiencies existent in previous electronic exchange proposals.

2. To develop a method for conducting a comparative evaluation of the proposed exchange relative to previous exchange proposals.

Admittedly, the electronic exchange is just one possible marketing mode which might be proposed as a remedy for the disadvantages of direct cattle marketing. Forker, for example, has recently examined group negotiations and bargaining, formula pricing, and committee pricing, and concluded that they are price determination mechanisms which could serve as alternatives to electronic exchanges. [9] Each of these alternative marketing modes studied by Forker retain the inherent advantages of direct
marketing while utilizing centralized price determination in an attempt to avoid the information shortages and lack of competitive bidding inherent in direct livestock marketing. Despite the potential offered by these marketing alternatives, the scope of this study has been limited solely to a consideration of electronic commodity exchanges.

The livestock marketing process has sometimes been temporally defined to encompass all intervening steps taken from the time cattle in the feedlot approach market weight until the resulting meat reaches the consumer's table. Nevertheless, for the purposes of this study only that segment of the cattle marketing process which begins where cattle in the feedlot approach market weight and continues until they arrive at the place of slaughter will be considered.

From a geographical standpoint the scope of this study is limited in that the proposed electronic exchange system is designed for deployment on a statewide, rather than a regional or national level.

The emphasis of this thesis is on the proposed exchange's design rather than the development of a plan for complete implementation. Thus, while recognized to be important, issues such as selection of a host market agency, initial promotion and attainment of sufficient trading volume, and legal problems, such as the steps necessary to make exchange participation compulsory or the drafting of marketing agreements, are not discussed.

While efforts have been made to develop a complete set of evaluative criteria, it is likely that the list of market criteria presented is not exhaustive.

And finally, this study does not report the results of any empirical analysis.
D. Overview of the Proposed Electronic Simultaneous Progressive Slaughter Cattle Auction

The Electronic Simultaneous Progressive Slaughter Cattle Auction (ESPSCA), the electronic cattle marketing system proposed by this study, combines the simultaneous progressive auction transaction system and a computer-monitored network of cathode-ray tubes to produce an improved electronic livestock exchange system. The specific advantages of the ESPSCA over previous electronic exchange proposals include: 1) market-determined quality price differential schedules and optional trading bases; 2) reduced interlot random price fluctuations; and 3) increased disclosure of bids on consigned lots, as well as consignor identification, which facilitates the formulation of bidding strategies.

To assist the reader in gaining an understanding of the ESPSCA, I now present a preliminary overview of the proposed exchange. Because this overview is intended to be a summary rather than a comprehensive description of the ESPSCA, definitions and technical explanations will be left until later in this thesis. The emphasis in this overview is on two aspects of the ESPSCA: 1) the distinguishing features of the ESPSCA; and 2) the conduct of the ESPSCA.

1. Distinguishing features of the ESPSCA

From a descriptive standpoint the distinguishing features of the ESPSCA are: 1) its use of the simultaneous progressive auction transaction system; 2) its multiple price determination, and 3) its use of computerized electronic equipment to conduct and monitor the auction.

The simultaneous progressive auction transaction system is utilized by the ESPSCA. Unlike the successive progressive auction transaction system
utilized by ordinary ascending price auctions which are characterized by incremental bids on lots offered for sale simultaneously, the simultaneous progressive auction transaction system is characterized by concurrent bidding on more than one lot, incremental bids on each lot, and when no bidder is willing to enter another bid on any lot, each lot is sold simultaneously to the last bidder on each lot.

Due to the "progressive" attribute of the simultaneous progressive auction transaction system it is possible to allow multiple price determination, or in other words, the entry of bids on more than one price for each lot. This feature makes it possible to offer a lot on several different trading bases and give either buyers or sellers the option of selecting which price or subset of prices is to be the basis for exchange. Multiple price determination also allows bidders to determine a base price and a quality price differential schedule for each lot.

While a simultaneous progressive slaughter cattle auction conceivably could be conducted without the use of electronic equipment, the exchange system presented below has been designed such that all five major auction functions are performed by or with the aid of electronic equipment. The first auction function, auction control, involves the coordination and monitoring of all other electronic systems and is performed by a high-speed electronic digital computer. The second auction function, consignment, involves the receipt of producer sale orders. The consignment function could be performed by a touch-tone telephone, a card-dialing telephone, a punched-card computer terminal, or a teletypewriter. The third auction function, sale bill communication, involves the transformation of electronic transmissions into a printed listing of consigned lot descriptions.
and could be performed by a teletypewriter terminal or line printer terminal located at the packer's buying office or broker's office. The fourth auction function, remote data transmission, involves the electronic transmission of consignments and bidding data between geographically remote locations. This function could be performed by a series of WATS lines, leased voice-grade telephone channels, and leased teletype channels. The fifth auction function, bidding, involves the determination of each consigned lot's exchange price. To perform the bidding function, each bidding station would be equipped with one or more cathode-ray tube (CRT) display stations. Each such station would be comprised of a cathode-ray tube, an alphameric keyboard, and a fiber-optic light pen.

2. Conduct of the ESPSCA

The ESPSCA would be conducted as follows. In the preparatory stage of the auction session any cattle feeder interested in consigning a lot of cattle for sale on the ESPSCA would use his touch-tone telephone to contact the ESPSCA headquarters. The cattle feeder would be greeted by the central processing unit's (CPU's) audio-response unit. By using a pre-established code, the cattle feeder could enter his identification number and request market information. Upon receipt of these transmissions, the CPU would verify that the requesting producer is a bona fide member of the exchange and verbally report the average, high, and low sale prices for cattle for specified trading methods during the current and previous auction sessions.

If the cattle feeder decides to consign one or more lots, he would transmit to the CPU the following consignment information: a) the number of lots to be consigned; b) the desired bases for each lot; c) the
number of head of each sex in each lot; d) the location of the cattle
at the time of sale; e) the auction session for which consignment is being
made; f) the desired delivery interval; g) the desired grading option; h)
whether his identity is to be revealed to bidders; and i) his reserve bids.
The CPU would verbally repeat the consignment details for consignor verifi-
cation, assign each lot a Lot Identification Number, and record the data in
the lot's consignment file. If the consignor so requested, a grader would
be dispatched and the grader's report would be included in the particular
lot's consignment file.

As the auction session approaches, the ESPSCA computer would prepare
an auction sale bill by compiling a list of lots consigned for sale during
this auction session. Subsequently, the computer would categorize these
lots by trading method, sex composition, and delivery interval. The com-
puter would then compile a lot description from the data in the con-
signment file for each lot. When completed, the sale bill would be trans-
mitted to each packer-buyer station.

Each participating packer-buyer is notified that the auction starting
time is approaching. Upon receiving the starting signal, each packer-
buyer operating a CRT display station could use his programmed-function and
alphabetic keyboards to enter command messages. These commands would per-
mit the buyer to view one or more lot bid arrays on his CRT display screen.
If the buyer desires to enter a bid on a particular lot displayed on his
screen, he would select the desired bid increment and depress the appro-
priate key on his programmed-function keyboard. The packer-buyer would
then enter the bid by pointing his display stations's fiber-optic light pen
at the last illuminated character in the previous bid for the desired lot
and lot component. Immediately after receipt and registry of the individual bid increment, the display would reflect the new incremental bid and an "X" at the bottom of the appropriate bid array, indicating that the particular buyer is now the high bidder on the lot. In addition, the new incremental bid is registered on the CRT display screen of any other buyer who also is viewing the bid array for that particular lot.

As the auction progresses, the number of bids entered per minute will decrease. When bid entrance drops to a predetermined rate per minute, the CPU would alert buyers that the end of the session is approaching. The cessation of bidding would be followed by the computerized identification of winning bidders. The final bid array on each lot would immediately be transmitted to the consignor, and the consignor would be asked to indicate, when appropriate, his choice of trading basis and the number of animals to be supplied. Each buyer would then receive a list of lots purchased, the trading basis for each lot, and number to be supplied from each lot. Finally, consignors would be given the name and telephone number of the buyer of each lot they had consigned.

E. Outline of the Following Chapters

The content of the remaining five chapters of this thesis is briefly outlined below.

Chapter II contains a review of the previously published proposals and attempts to operate electronic commodity exchanges. Review of these proposals exposes the strong and weak features of each, indicates those refinements which should be incorporated in a new electronic exchange proposal, and provides a basis for identifying the significant improvements in
my exchange proposal.

In Chapter III a set of twenty potential flaws in the design, operation, structure, and exchange outcomes of previous and future electronic exchange proposals are identified.

Chapter IV contains a detailed development of the proposed Electronic Simultaneous Progressive Slaughter Cattle Auction (ESPSCA). This development begins with the selection of an auction transaction system. The development then progresses through descriptions of a simple simultaneous progressive cattle auction and a nonelectronic multiple-price simultaneous progressive slaughter cattle auction, before finally presenting the electronic version of the auction.

In Chapter V the set of market flaws presented in Chapter III are used as a basis for developing evaluative market criteria. Once stated, each criterion is then applied to the previous electronic exchange proposals and the ESPSCA in conducting a comparative evaluation of the proposals.

The final chapter, Chapter VI, summarizes the conclusions which can be drawn from this research, identifies the advantages offered by the simultaneous progressive auction transaction system and the ESPSCA over previous electronic exchange proposals, and outlines the issues which need further research before an attempt is made to implement the ESPSCA.
II. REVIEW OF LITERATURE: PREVIOUS ELECTRONIC COMMODITY EXCHANGE SYSTEM PROPOSALS

A. Introduction

In recent years marketing economists have made various proposals for electronic agricultural commodity exchange systems. Several of these proposals have actually been implemented by producer organizations and some have operated for as long as seventeen years. This chapter presents a survey of prior proposals which will provide a basis for comparing these earlier proposals with the proposal presented in this study.

The previously proposed electronic exchanges may be grouped into three classes: 1) telephone auctions; 2) teletype auctions; and 3) computerized exchanges. This classification scheme separates the proposals on the basis of the type of electronic equipment used to conduct the exchange transactions and the type of transaction system used to determine the exchange price.

While not all of the exchanges discussed were designed to accommodate the sale of slaughter cattle, an examination of the organization and electronic hardware utilized by each of these proposals will reveal the design characteristics and components needing further research and refinements.

In those cases where the proposal has been made operational, the discussion will focus on the operational exchange and factors attributing to its success or failure. In all other cases, the discussion will focus on the proposal itself.

In the discussion associated with each of the three classes, I will initially provide an introductory overview which covers the elements common
to each proposal in the class. Included in this overview will be a discussion of the type of commodity assembly system employed, pertinent transactions rules and procedures, and the type of electronic equipment characteristic of the particular class of electronic exchanges. The discussion of each exchange system class will then turn to an examination of the unique characteristics of each exchange proposal.

B. Telephone Auctions

1. Basic auction organization

The least sophisticated type of electronic exchange proposal utilizes a telephone conference call to communicate among up to fifteen geographically separated bidding points and the central auction headquarters in the conduct of a conventional (ascending price) auction.

Preparation for the telephone conference call auction begins with the producer's delivery of commodities to his regional assembly point. In the case of livestock, the assembly point normally consists of loading and unloading facilities, livestock scales, animal holding pens, and a communication device, usually either a telephone or teletypewriter, linking the assembly point with the auction headquarters. Once unloaded at the assembly yard, a producer's animals are inspected by a veterinarian, ear-tagged or tattooed to identify the producer, graded on a live basis, weighed, and penned into lots of similar weight and grade. [22, p. 34; 23, p. 8] When this handling has been completed, the yardman at each assembly yard communicates, either by telephone or teletypewriter, the description of each lot consigned at his assembly yard to the central auction headquarters. Upon the receipt of all lot descriptions from the assembly yards, the headquar-
ters staff compiles a master sale order and makes it available for examination by all potential bidders prior to the bidding.

At a prearranged time potential bidders assemble at each bidding station and establish communication with the central auction headquarters via the telephone conference call. The bidding stations may be geographically removed from the regional assembly yards and the central auction headquarters. At the central auction headquarters, an auctioneer begins the auction by seeking bids on the first lot scheduled for sale. By means of the telephone conference call bidders at their spatially remote bidding stations are able to hear the auctioneer's solicitations for bids and the bids as made by competing bidders at their own and other bidding stations. When an individual bidder at a particular bidding station wishes to enter a bid, either his bidder number or name is transmitted to all other bidders and the auctioneer. Just as in an ordinary auction barn situation, the auctioneer senses when the bids have probably reached their high point and sells the lot by knocking it down to the highest bidder. The auction then progresses in a similar and successive manner in the sale of each lot on the master sale order. When all lots have been sold, the auction is recessed until the next session.

All of the livestock telephone auctions have required that consigned livestock be graded prior to sale and that the livestock be sold on a live-weight basis. Because none of the telephone auctions permit livestock trading on a carcass merit basis, no attempt has been made to utilize a market-determined quality price differential schedule.
2. Operational experiences with the telephone auctions

In the past fifteen years a number of producer groups in various states have organized producers and commodity buyers to establish and conduct telephone auctions. In the paragraphs below, I will briefly summarize the distinctive characteristics of several operational telephone auctions.

a. Missouri Farmers Association feeder pig telephone auctions

One of the most successful telephone auctions is the Missouri Farmers Association (MFA) feeder pig telephone auction. The auction was organized by the MFA Livestock Association, a farmer cooperative headquartered in Marshall, Missouri. [22, p. 34] Annual trading volume on this auction in 1971 was approximately 416,000 head. [22, p. 34]

Since the first MFA feeder pig auction was held in December 1965, the Association has held auctions on one or two evenings each week. Before each auction session pigs are assembled at either two or three of the ten assembly yards operated by the Association such that each assembly yard is used only once every two weeks. [22, p. 34]

The MFA feeder pig auction utilizes a fifteen-hookup conference call [15, p. 23] to permit communication between the auctioneer and fifteen remote bidding stations. At each bidding station potential bidders assemble to hear the conversation on the conference call network. Before being admitted to the bidding station premises, the "ringman" in attendance verifies that each purported bidder is in fact a bona fide buyer. [23, p. 8] To enter a bid during the auction, a bidder notifies the ringman at his bidding station of his intentions. The ringman in turn enters the bid by announcing the bidding station's number to the auctioneer over the telephone network. The ringman's announcement signifies that he has received
a bid at his bidding station pursuant to the auctioneer's solicitations. Accordingly, the identity of the individual bidder may be known by those competing bidders assembled at the individual's bidding station. However, the individual bidder's identity remains anonymous to all bidders assembled at the fourteen other bidding stations. [22, p. 34]

The MFA experience shows that it takes approximately one minute to sell each lot and approximately thirty minutes to conduct the entire auction session. [22, p. 34] In 1971, the volume of trading during each auction session averaged slightly less than 3,000 pigs. [22, p. 34]

All feeder pigs are sold subject to the terms: payment - cash on delivery; and shipment - F.O.B. assembly yard. Buyers are also required to pay a 25 cents per head charge for eartagging and the cost of vaccination. The MFA Livestock Association in turn provides the buyer with a 98-100 percent "livability" guarantee. [22, p. 34]

For use of the telephone auction service, which includes the cost of periodic on-the-farm inspection, handling (sorting, grading, and weighing) at the assembly yard, communications, and the auctioneer, [23, p. 8] producers in 1971 were charged between $1.25 and $1.50 per head, depending on the average weight of the pigs consigned. [22, p. 34]

b. Missouri Farmers Association slaughter hog telephone auction

Apparently encouraged by the initial success of their feeder pig auction, the MFA Livestock Association started a weekly telephone auction for slaughter hogs in March 1968, which was conducted in much the same manner as the Association's feeder pig auction. Slaughter hogs received at one of two assembly yards on Monday of each week were sold via telephone auction on Tuesday. [23, p. 9] Upon arrival at an assembly yard, each producer's
hogs were unloaded, identified by owner, grades, and penned into uniform saleable lots. 1 [22, p. 34]

Each auction session normally included the participation of from ten to fourteen packer-buyers. [23, p. 9] The MFA slaughter hog auction differed from the Association's feeder pig telephone auction in that with the slaughter hog auction, each of the packer-buyers was given his own phone and identified only by number in an effort to preserve bidder anonymity. [22, p. 34; 23, p. 9] The weekly volume of trading during the auction's brief period of operation averaged about 1000 head. [23, p. 9]

Terms of sale were the same as for the MFA feeder pig telephone auction. [23, p. 9] For the auction services, the participating producers were charged 80 cents per head sold, and the buyers were charged 12 1/2 cents per hundredweight. [22, p. 34; 23, p. 9]

Operation of the MFA slaughter hog telephone auction was discontinued after only fifteen months. [22, p. 35] According to MFA officials, cessation of auction operations was the result of high operating costs and competition with MFA-operated local slaughter hog markets. [22, p. 35]

c. Maine egg auction Another telephone auction with a brief operational history was organized by Maine egg producers in late 1961 in an attempt to improve the egg pricing process. Promoters hoped that the organized auction marketing system would build confidence in the quality of their product, as well as serve as a major source of pricing information.

Prior to each auction session, producers graded and cartoned their

1 The penning arrangement in essence resulted in a pooling of animals such that the animals in each pen might be the product of several producers.
eggs, and then delivered them to one grading plant in Portland, Maine, where they were inspected by a federal-state grader. [23, p. 10] After delivery, the weekly auction, involving seven or eight buyers, was conducted on Tuesday morning. During the conduct of the Maine telephone auction, participating bidders were identified by name. [23, p. 10]

It should be recognized that telephone auction exchange systems which require sales by description are better adapted to selling eggs than livestock. This superior adaptability of eggs to telephone auction trading arises from the fact that eggs are readily and accurately graded in an objective manner; whereas, livestock grading requires reliance on a subjective, and often inaccurate, visual appraisal method. Consequently, a newly established egg telephone auction should more readily receive the confidence of bidders than a comparable telephone auction for livestock.

Two reasons cited by participants for the egg auction's lack of success were: 1) the auction was started in a period of a general egg surplus with consequential low prices; and 2) that promoters moved so rapidly from the proposal to operational stages that potential buyers simply did not have time to make a decision to participate. [23, p. 10]

d. Iowa Sheep Producers' tele-auction

On March 3, 1976, the board of directors of the Iowa Sheep Producers' Association voted to enter an agreement with the Interstate Producers' Livestock Association (IPLA) of Peoria, Illinois, to conduct a tele-auction (telephone auction) for market lambs, ewes, and rams in Iowa. [24] Under the agreement, IPLA will furnish the personnel necessary to conduct the tele-auction and will serve as the producer's sales agent. [24] In addition, IPLA will grade all consigned sheep prior to each auction by sending a qualified grader to the pro-
ducer's farm. [24] By participating in the tele-auction, producers give the IPLA sales agency the authority to accept or refuse all bids in their behalf. After a sale has been consummated, the producer will be required within seven days to transport his sheep, at his own expense, to a designated assembly point operated by IPLA. [24] Additionally, IPLA guarantees the payment for all sheep sold through the tele-auction once IPLA's Peoria office has received weight tickets from the assembly point manager. [24]

To participate in the tele-auction a sheep producer must be a member of the Sheep Producers' Association and sign a marketing agreement designating IPLA as the marketing agency for his sheep. The marketing agreement runs from April 1st to March 31st and is automatically renewed unless IPLA receives a written termination notice from the producer. In addition, producers must pay IPLA a $1.00 per head fee for each head sold through the tele-auction. [24]

IPLA officials have reported that 36 packers have indicated interest in participating in the new sheep tele-auction. [24] The officials have expressed their hopes that after a series of spring informational meetings with sheep producers, the required minimum commitment of 50,000 sheep will be achieved. If the minimum producer commitment is attained, officials plan to hold the first auction in June 1976. [24]

e. Other telephone auctions  In 1970 telephone auctions were also operational in Virginia and Wisconsin.

The Virginia Tel-O-Auction was initiated in 1962 by the Virginia Department of Agriculture, Division of Markets, and the Chesapeake and Potomac Telephone Company. [15, p. 22] Although originally designed to market feeder pigs, it was subsequently expanded to also handle slaughter cattle
and hogs. [15, p. 22]

In 1970 two telephone auction organizations, dealing primarily in feeder pigs, remained operational in Wisconsin. Although both Wisconsin telephone auction groups had at one time sold butcher hogs via telephone, only the Midwest Livestock Producers' Association of Wisconsin was still selling butcher hogs by telephone in 1970. [15, p. 23] As with the Virginia slaughter hog telephone auction, the Wisconsin slaughter hog auction was hampered by low selling volume. [15, p. 23]

C. Teletype Auctions

A second and more sophisticated type of exchange proposal employs a teletype network to communicate between geographically separated bidders and the auctioneer in the conduct of a successive regressive (declining price or "Dutch") auction. The successive regressive auction framework utilized by the teletype auctions is similar to the successive progressive auction format used by the telephone auctions in that individual lots are sold "successively," or one after another. However, the successive regressive auction differs from the successive progressive auction in that each solicited bid on a lot is decrementally lower \(^2\) during the regressive auction and incrementally higher during the progressive auction.

1. Basic teletype auction organization

The three standard electronic components in each of the teletype auction proposals are 1) the master teletype, which serves as the central sell-

\(^2\)This regressive or declining price attribute appears to be responsible for the random lot-to-lot price fluctuation between lots successively sold on the operational teletype commodity auctions.
ing unit; 2) the electronic broadcast repeater; and 3) the teletype buying machines.

When the sale of a lot appears to be favorable, the master teletype operator is given a written sale order by a member of the headquarters sales staff. [23, p. 6] The operator then types the assembly yard identification number or feedlot location, the lot number, and the number of animals in the lot, from the sale order, as well as the present data and time, on the master teletype's keyboard. [23, p. 6] The operator of the master teletype then causes the machine to start broadcasting from a prepunched price tape. The particular tape has been preselected for use in selling the particular livestock lot by the market agency sales staff and represents a certain price spread. The tape is prepunched in uniform price decrements, such as five cents per hundredweight, beginning with the higher priced end of the price spread. Each price on the tape represents a price in dollars per hundredweight, at which the selling agency is soliciting bids.

The electronic broadcast repeater, which is assigned the job of monitoring electronic impulse transmissions, is a specially designed unit connected to the master teletype to form a part of the centralized selling unit. [7, p. 90] The electronic broadcast repeater appears as a panel displaying a series of letters, each serving as the identification code for a particular buying machine. Above each identification letter is a white light which flickers when the system is in operation, indicating that the particular machine is receiving the bid transmission from the master teletype. [7, p. 90] Below each identification number on the panel is a red light which flashes when the particular buyer was the first to bid on the
lot currently being auctioned. [7, p. 90]

When the operator of the master teletype types the descriptive details on his keyboard, each of the geographically removed bidding machines simultaneously receives this transmission and prints it on the machine's recording paper. As the broadcast from the prepunched tape begins, each of the buying machines simultaneously receives and prints the first bid solicitation. A few seconds later, the buying machines receive the transmission of a decremental bid solicitation and print this amount. This process is repeated until either a buyer observes a solicitation for a price he is willing to pay and depresses the bidding button on his buying machine, or the last bid solicitation on the prepunched tape is transmitted with an accompanying warning without a bid being entered. The first packer-buyer to enter a bid on the lot will be the successful purchaser of the lot. The lot purchase price will be the one most recently printed by the buying machine at the time the buyer entered his bid.

When the first bid on a lot is entered, the red light under the bidder's identification letter on the electronic broadcast repeater panel flashes. [7, p. 91] Immediately thereafter, the teletype broadcasting circuit is broken, leaving only the successful bidder's machine and the master teletype in contact. The master teletype then automatically prints the identification code letter of the successful bidder on the machine's recording sheet. [7, p. 91] Subsequently, the successful bidder confirms the transaction by typing the letters "OK" on his buying machine's keyboard. The master teletype then broadcasts the lot's selling price to all buying machines, but does not reveal the identity of the successful bidder. [7, p. 91]
When the transmission of prices from the prepunched tape is completed without a bid having been entered for a particular lot, another attempt may be made to sell the lot later in the auction session. [7, p. 91] The timing and price of the resolicitation is at the discretion of the sales agency staff. [23, p. 6]

2. Operational experiences with the teletype auction

Discussed in this section are four different attempts to establish teletype livestock auctions. The success of the first three efforts, all of which arose in various Canadian provinces, can be reflected in part by the fact that the resulting auctions remain operational at the time of this writing. By contrast, the fourth attempt, which was staged by cattle producers in the state of California, was rather unsuccessful. In the following discussion most of the attention will be focused on the Ontario auction which was the first known attempt to establish an operational teletype livestock auction. Following this discussion will be a brief comment on the organizational differences in the teletype auctions established in Manitoba, Alberta, and California.

a. Ontario teletype auction

The Ontario teletype auction, which first became operational on May 8, 1961, was established by a producers organization, the Ontario Pork Producers' Marketing Board. The success of the Ontario teletype auction has allowed the concept to gain widespread producer and packer approval, thereby encouraging the establishment of tele-

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3 At the time of the auction's origin, this organization was called the Ontario Hog Producers Marketing Board. However, the name was subsequently changed. Accordingly, all reference to the organization hereinafter will be made as "Ontario Pork Producers Marketing Board."
type auctions under modified organizational plans in the Canadian provinces of Manitoba and Alberta.

The Ontario teletype auction utilizes eighteen buying machines, seventeen of which are located in the offices of various packers around the province. The eighteenth buying machine is located at the headquarters office of the sales division of the Ontario Pork Producers Marketing Board in Toronto, Ontario, and is used by the sales division's staff to enter the bids of small packers in the province not having their own buying machines. 4 [22, p. 30]

The prepunched tapes used by the master teletype each represent a one dollar spread, divided into five cent graduations. The tapes are punched such that the highest price is first transmitted and printed by all buying machines, followed by each of the lower prices in declining order. 5 In those instances where the entire one dollar price spread represented by a tape is broadcast without a bid being entered, the Ontario teletype system is set up such that the last price is reprinted three times, with a bell being sounded on each buying machine between the three repetitions. [7, p. 91] If still no bid is registered, the words "NO SALE" are transmitted and printed by each buying machine.

In the Ontario teletype slaughter hog auction the sales staff of the

4 Approximately one percent of the hogs sold through the Ontario teletype auction are purchased by the sales division for the small packers. [23, p. 5]

5 The tape for the $48.00 to $47.00 per hundredweight spread would be punched such that it would result in the following transmission if not stopped by the entry of a bid:

<table>
<thead>
<tr>
<th>48.00</th>
<th>47.95</th>
<th>47.90</th>
<th>47.85</th>
<th>...</th>
<th>47.20</th>
<th>47.15</th>
<th>47.10</th>
<th>47.05</th>
<th>47.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>47.00</td>
<td>47.00</td>
<td>NO SALE.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
sales division of the Ontario Pork Producers' Marketing Board plays a key role in the price determination. Not only does the sales staff decide the sale order and timing, but it also makes the determination of the price range, and thus the prepunched tape to be used in soliciting bids. In reaching this decision, the sales staff takes into consideration 1) the composition of the particular lot; and 2) the current market conditions. [22, p. 31]

The teletype system used by the Ontario hog auction is sensitive enough to distinguish between bids entered 1/1000th of a second apart. [22, p. 31; 23, p. 6] Ontario auction officials state that it generally takes between 30 to 60 seconds to sell a lot of hogs on the teletype auction. [22, p. 31]

1) Influence of national legislation The implementation and success of the Ontario teletype auction stems largely from two pieces of national legislation. [22, p. 29] One of the national laws allows provincial governments to pass legislation enabling agricultural producers to establish organizations designed to control specific marketing operations related to a product produced within the province. [22, p. 29] While the powers granted to producer boards by provincial legislation varies from province to province, producer marketing boards in Ontario have been granted power to establish and control a sales agency with total authority over the trading of a particular farm product. [22, p. 29] Furthermore, Ontario law enables its marketing boards to compel resident producers to comply with any marketing plan adopted by the board. [22, p. 29] This piece of national legislation has been significant in the organization and success of the Ontario auction because it has enabled Ontario to enact legislation
allowing the Ontario Pork Producers' Marketing Board to compel all resident pork producers to market their hogs through the Board's teletype auction.6

The effect of the compulsory marketing requirement was to assure that a large volume of hogs would utilize the teletype auction.

The second Canadian law having great influence on the success of the Ontario hog auction is that requiring all slaughter hogs to be purchased on a carcass grade and weight basis. [22, p. 31] Under this law all hog carcasses are graded according to a Canadian national grading system which includes the quality price differentials established by the Canadian Parliament.7 This legislation has greatly facilitated the establishment of a marketing system where buyers do not make visual inspection of the livestock prior to entering their bids. The required carcass grade and weight provisions assured packers that despite their lack of visual inspection, they would be able to sufficiently dock carcasses not conforming with top quality. In addition, the provisions denied producers the chance to shy away from carcass grade and weight sale provisions in lieu of a seemingly more certain live basis sales arrangement. Furthermore, this legislation has eliminated the need for live grading of the hogs by the sales agency

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6 In 1973, direct sales by producers to local butchers slaughtering less than 50 hogs per week were exempt from the compulsory marketing laws. [22, p. 30]

7 Under the Canadian grading system, a separate grade category is designated for each possible combination of carcass weight and backfat. [22, p. 31] In addition, the national legislation has assigned a specific index value to each grade category. Since in computing the price per hundredweight to be paid for an individual hog carcass, the index value is multiplied by the base price determined by the regressive auction, the price differentials for different quality hogs under the Canadian system, are incorporated in the grading system through the value indexes. [22, p. 31]
prior to their sale on the teletype auction.

2) **Assembly of hogs prior to each auction session** Before sale procedures may be commenced, the Ontario pork producer must deliver his animals to one of the 45 hog assembly yards located throughout the province. [22, p. 30; 23, p. 5] Upon arrival at an assembly yard, the producer's hogs are unloaded, tattooed for carcass identification, and penned into lots containing the number of animals specified by the headquarters sales staff. [22, p. 30] However, the hogs are not graded. [22, p. 30] Once a lot of hogs is ready for sale, the manager of the assembly yard notifies the sales agency headquarters in Toronto. Nine of the 45 assembly yards are equipped such that this notification and other pertinent communication with the headquarters can be made by teletype. [7, p. 91] For the remainder of the assembly yards, this communication is made by telephone. [7, p. 91]

3) **Charges for use of the Ontario teletype auction facilities** The levy of fees for use of the Ontario teletype auction is divided between the utilizing producers and packers. In 1973, producers were assessed a fee amounting to 1.25 percent of the sale price of hogs sold through the auction. [22, p. 31] Producers were also required to pay the cost of transporting the hogs from the farm to the assembly yard. To cover the cost of operating the teletype system, utilizing packers are assessed a per head fee. Furthermore, the packers are required to pay the cost of transporting the animals purchased from the assembly yard to their processing facilities. [22, p. 31]
b. **Manitoba teletype hog auction** Although patterned after and operated in much the same manner as the Ontario teletype hog auction, the Manitoba version, established in February 1965, varies in several fundamental aspects. First, marketing of hogs through the Manitoba teletype auction is not compulsory. [22, p. 30] Nevertheless, the producer's decision to avoid utilization of the teletype auction is subject to the following requirements: 1) the producer must submit a written request to the marketing commission, requesting permission that he might sell his hogs directly to a packer; and 2) the nonutilizing producer must pay the same fee he would have had he utilized the teletype auction. [22, p. 30] Secondly, the Manitoba teletype auction is operated under the auspices of a marketing commission, rather than a marketing board. [22, p. 30] A third distinguishing feature of the Manitoba teletype auction relates to hog assembly. In Manitoba, only two hog assembly yards are utilized and neither of these is owned by the Manitoba Hog Marketing Commission. [22, p. 31] Instead, many hogs are sold on the Manitoba teletype auction while en route from the farm, and delivered directly to the successful packer-buyer, thereby eliminating interim handling associated with preauction assembly of hogs. [22, p. 31] The sale of hogs en route is made possible by the fact that almost all of the packing plants in Manitoba are located at Winnipeg, thus necessitating shipment to that city, regardless of the ultimate packer-buyer. [7, p. 169] A final distinctive feature of the Manitoba auction is that it allows

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8 A "market commission" may be distinguished from a "marketing board," in that commission members, who need not be producers, are appointed by the government, while board members are producers elected to serve fellow producers. [22, p. 30]
each producer the option of having his name transmitted to each potential bidder along with the description of his lot of hogs. [22, p. 31]

In 1973, both the producers and packers were charged 30 cents per head for hogs marketed through the Manitoba teletype auction. [22, p. 31]

c. Alberta teletype hog auction In Alberta, Canada, a teletype auction system similar to the Ontario system became operational in October 1969. [22, p. 30] The Alberta teletype hog auction operates in much the same manner as the Ontario auction; however, in Alberta the mode of hog assembly in the auction system deviates from that employed in Ontario. [22, p. 31] The Alberta auction's controlling body, the Alberta Hog Marketing Board has designated six hog delivery points, although the board does not operate assembly yards at these points. [22, p. 31] In addition, the board has licensed more than 500 hog assemblers at more than 300 locations, to receive hogs from producers and sell them through the teletype auction. [22, p. 31] Another assembly feature of the Alberta auction permits sale of a producer's hogs while they are still in his feedlot. [22, p. 31] This feature enables direct shipment to the purchasing packer without interim handling.

The Alberta auction has followed Manitoba in permitting producers to have their name included with the lot description transmitted to each potential bidder and in the 30 cents per head fee assessment to both utilizing producers and packers.

d. California Integrated Data Auction One attempt to employ a teletype auction system in the United States similar to that used in Canada was initiated by the California Farm Bureau Marketing Association. [7, p. 114] Trading on the California Integrated Data Auction (I.D.A.) consisted
primarily of slaughter and stocker and feeder cattle. [7, p. 114] Participating in the I.D.A. were eighteen feedlots and six packers. Rather than require preauction assembly at a centralized assembly yards, the I.D.A. was organized to allow two different types of sales services, each of which required sales of cattle while still in the feedlot (slaughter cattle) or on the range (stroker and feeder cattle). One of the I.D.A. sales services allowed an I.D.A. representative to visit the ranch or feedlot prior to an auction session, inspect and grade the cattle to be sold, and report his lot description to the I.D.A. sales staff, for relay to all potential bidders. [7, p. 114] The alternative I.D.A. sales service permitted feedlot owners to describe their own cattle, with this description being made available to all potential bidders. [7, p. 114] Cattle lot descriptions were made available to potential bidders several days in advance of sale in order to allow the bidders to visit the feedlots and personally inspect the animals, if they so desired. [7, p. 114-15]

The conduct of the auction itself was very similar to that in Ontario, except that the I.D.A. utilized ten cents per hundredweight price solicitation decrements every two seconds [77, p. 115], as compared to the five cents per hundredweight decrement every three seconds used in the Ontario auction.

To further the dispersement of economic information, the I.D.A. tele-type network was used to broadcast reports of the U.S. Department of Agriculture Market News Service. [7, p. 115]

Due to what auction officials cited as "the unwillingness of sellers to offer feeder or fat cattle at realistic prices," the California Farm Bureau Marketing Association terminated operation of the I.D.A. in 1963.
[7, p. 115] Auction officials also stated that participants had been critical of the regressive auction format, stating that it was "perhaps ahead of its time in California." [7, p. 115]

3. Johnson's recent proposal for a national slaughter cattle teletype auction

After making an extensive study and evaluation of the marketing efficiency, bargaining position, and industry applicability of eight alternative methods of marketing fed cattle, Johnson concluded that substantial gains would accrue to the beef industry if the present fed cattle marketing modes were abandoned in lieu of a nationwide teletype auction system similar to that employed in Ontario, Canada, for the sale of slaughter hogs. Johnson's conclusion that the teletype auction was the most desirable method of marketing fed cattle was based on comparative rankings of the eight marketing methods examined as to the three criteria. Johnson's rankings indicated that the teletype auction ranked first among the eight

9 Johnson defined "marketing efficiency" to include both operational or physical efficiency, which he said was measured by the total marketing cost per head, and pricing efficiency. [15, p. 31]

10 Johnson defines "bargaining position" as the "protection or lack thereof that a particular selling method offers the producer against short-run price declines due to local and/or temporary market disturbances." [15, p. 51] Johnson notes that this protection is to a large degree "inversely related to selling flexibility cost, which is defined as the cost associated with refusing to accept the offered price and not selling until some later time...." [15, p. 51]

11 "Industry applicability" is defined as "the physical or operational capability of a selling method to simultaneously service the entire industry...." [15, p. 54]

12 Terminal marketing, auction market, direct, country commission firm, telephone auction, telephone direct, and teletype auction. [15, p. 15]
methods in pricing efficiency [15, pp. 6 and 50] and industry applicability
[15, pp. 6 and 54], while being tied for first in the bargaining position
criterion. [15, pp. 6 and 51] In addition, the teletype auction method
ranked second with respect to the least total marketing cost criterion.
[15, p. 39]

While the teletype auction advocated by Johnson in his 1972 proposal
would be conducted in a manner similar to the Ontario Pork Producers slaugh-
ter hog teletype auction, certain modifications were envisioned. One modi-
fication involves expansion of the auction from a provincewide to a nation-
wide scale. As viewed by Johnson the nationwide auction would utilize up
to 164 teletype buying machines [15, p. 71], whereas only eighteen buying
machines were operative in the Ontario auction. Another modification made
by the Johnson proposal eliminates the need for assembly because all cattle
would be sold while still in the feedlot. [15, pp. 8 and 65] This modifi-
cation is advantageous because it enabled Johnson to include in his proposal
provisions allowing the purchasing packer to specify the desired date of
delivery, up to fourteen days after the date of purchase. [15, pp. 8, 62,
and 66]

Some of the other distinctive differences in the Johnson proposal from
the Ontario auction include the following. First, due to the comparatively
large number of buying machines and the expected large volumes, Johnson rec-
ognized the need to add a fourth electronic component to the teletype auc-
tion system - a small computer which controls and monitors the auction sys-

13 In his study, Johnson concluded that consignment selling was the
least cost method of marketing cattle. [15, p. 39]
tem. [15, p. 63] A second distinctive feature of the Johnson proposal is the provision for nine regional order buyers, each equipped with a teletype buying machine. [15, p. 71] The order buyers would operate out of the market agency's central headquarters and would be employed by packers in their assigned region who slaughter less than 25,000 fed cattle annually. According to Johnson, these packers can not economically afford to be equipped with their own teletype buying machine.¹⁴ Third, the Johnson proposal would utilize a nationwide Wide Area Telecommunications Service (WATS) communication network to facilitate consignment and confirmation communications between the approximately 200,000 cattle feeders and the market agency sales headquarters. [15, p. 69] Fourth, in order for the market agency sales headquarters to communicate with the 164 buyers equipped with buying machines, Johnson proposed the use of a teletype communication network as being the most expedient and economical method of providing two-way communication as well as providing the recipient with a printed copy of any message received. [15, p. 71] Fifth, because the use of a relatively small number of assembly yards having known locations as in the Ontario hog auction has been deleted from his proposal and replaced by about 200,000 feedlot locations, Johnson included in his proposal a plan to utilize a cattle production zone system. This production zone system is based on a national map which divides the country into 1200 sequentially numbered squares, each representing 50 miles on a side. [15, p. 66] By use of this system, the location of any of the approximately 200,000 U.S. cattle feeding

¹⁴ Johnson notes that it would be operationally and technically possible to equip each of the more than 500 firms nationwide slaughtering cattle with their own buying machine. [15, p. 69]
locations could readily be identified and communicated with sufficient accuracy. [15, p. 66]

On the issue of compulsory marketing systems, Johnson's discussion of the advantages and disadvantages seems to indicate that he would favor having his teletype auction operated as a producer-imposed compulsory marketing system similar to the one in existence in the Canadian province of Ontario. [15, p. 58-59]

Among the responsibilities of the market agency sales staff under the Johnson proposal is the establishment of quality and yield grade price differentials. [15, p. 62] This differs from the situation in Canada where price differentials for different carcasses were incorporated into index values in the Canadian grading system established as part of national legislation.

D. Computerized Bid-Offer Matching Exchange Systems

1. Basic computerized exchange format

At least three recent proposals [11, 12, 23] have further developed the concept of centralized electronic price determination from that employed in the teletype auctions. The most significant advancement in these recent proposals is their utilization of high-speed electronic computers as the central component of the exchange system. Through the use of computers, the electronic exchanges will be better able to handle the higher volumes

\[15\] Knowledge of the location of the cattle at the time of the sale is essential in enabling the potential buyers to estimate feedlot to plant transportation costs and to assist the market agency sales staff in selecting the appropriate price range from which to solicit bids. The latter determination is crucial in the staff's selection of prepunched tapes.
of trading incurred by an exchange operating on a nationwide scale. The three computerized exchange proposals were designed to accommodate the wholesale marketing of shell eggs [23], the marketing of slaughter hogs [12], and the marketing of feeder cattle [11]. Each proposal calls for voluntary producer marketing through a nationwide exchange.

The exchanges designed to handle eggs and hogs were intended as "forward contract" exchanges meaning that the unit of commodity could be sold with deferred delivery from one up to more than 60 days after the date of sale. [12, p. 17; 23, p. 18] This is significant in that it allows the processor-purchaser to schedule his weekly commodity receipts and adjust his labor force accordingly. Furthermore, a "forward contract" exchange enables a producer to sell his product at the present price if he foresees a lower price at the time his product will be ready for sale and delivery. Thus, these are two advantages associated with sales through a forward contract market as compared to sales through a conventional "spot" market.

In order to accommodate computerization the three exchange designers have chosen to abandon the auction-type transaction system in lieu of a computerized procedure which matches processor bids and producer offers on the basis of price, delivery period, and delivery point. The basic format of this computerized matching transaction system is now discussed.

Producers and processors would have access to the exchange via touch-tone telephone [12, pp. 13-14], by merely depressing the phone keys corresponding to the exchange's telephone number and the producer's or processor's identification code. Large volume processors may find it economically feasible to substitute teletype communication in lieu of the touch-tone telephone. [12, p. 53; 23, p. 17] Through the medium of his touch-tone
telephone, the trader will be able to hear audio replies made by the exchange's computer in response to the numerical entries the trader makes by depressing certain numbers on his phone. Once the computer has identified the trader as a bona fide member of the exchange, the trader will be able to request certain market information pertaining to specified delivery periods, production zones, and delivery zones. The normal computer audio response to a trader request for market information concerning a specified trading zone and delivery period would make the following data available to the inquiring trader: 1) highest current bid by buyers; 2) lowest current price offer by sellers; and 3) price at which the last transaction was consummated. [23, p. 18]

If after hearing the requested market information the trader decides to enter a bid or sales offer, this may be accomplished by depressing the touch-tone phone buttons corresponding to the appropriate coded consignment message.

Normally, the producer-seller has the option of entering either a simple or complex sales order. A simple sales order is used when the seller is unwilling to deliver his produce to a delivery zone other than the one in which the commodity was produced. The simple sales order consists of a single offering price and the request that the computer match it with a bid from a buyer located in the producer's zone. A complex sales order consists of a single base offering price, similar to that which would be given

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16 Due to the potential for error in depressing buttons, Schrader envisioned the need for devising a computerized system of decoding, audibly repeating the trader's message, and requesting the trader's confirmation, in an effort to prevent unwanted transactions. [23, p. 28]
in using a simple sales order, and a transportation adjustment schedule. The transportation adjustment schedule consists of a list of zones other than the zone of production, to which the producer would be willing to deliver his commodity, and the incremental price per unit by which the price bid by a processor in a distant zone would have to exceed the base price in order to compensate the seller for the cost of transportation to the distant zone. Upon receipt of a complex sales order, the computer automatically adds the per unit offering price to the incremental per unit transportation cost to each zone listed on the schedule, to derive a set of transportation adjusted offering prices. These adjusted prices are then automatically compared with bid prices for the appropriate delivery data in the respective delivery zones. A bid price in any of the specified delivery zones which equals or exceeds the adjusted offering price would be sufficient to consummate a sale.

Because a buyer is not required to pay for the cost of transporting the commodity, his only concern is the per unit price he must pay for the commodity when delivered to his facilities. Thus, the bidder will merely submit a simple purchase order which specified the per unit price he is willing to pay for a stated quantity of the commodity when delivered to his plant.

Upon the receipt of a trading order, the computer automatically makes any necessary transportation cost adjustments and searches its memory files in an attempt to find a bid or offer which corresponds as to grade (when

\[17\] A per unit charge for additional shrinkage associated with longer shipping distances may also be incorporated into this transportation adjustment schedule.
applicable), delivery date, and price, such that a trade can immediately be consummated. If a sale can immediately be consummated, the computer’s audio-response unit automatically reports the transaction price, as well as the name and telephone number of the trader with whom he has been matched, to the trader via his touch-tone telephone call. If a sale can not be immediately consummated, the bid or offer is stored in the computer’s memory files until either a sale can be consummated, the time of the trading order’s expiration, or the trader cancels his bid or offer. Once a delayed sale is consummated the computer can use its audio-response unit to place a confirmation telephone call to the trader. In addition to confirming the sale, the audio-response unit can give the trader the name and telephone number of the trader at the other side of the transaction. Using this telephone number the trader can contact the other party to the transaction and make a delivery appointment.

One of the major computerized exchange design considerations was the amount of telephone communication capacity required. The exchange designers estimated that each transaction on the exchange would require more than three telephone calls. Necessary telephone calls were expected to include those by the seller in entering his bid and the confirmation call to the seller. In addition, telephone calls likely would be made in seeking price quotations and in modifying bids or offers. [23, p. 25] Where trading volume makes it economically feasible, Holder [12] suggested that the exchange make available an ample number of inward and outward WATS lines for

18 The adjusted offer and bid price need not always be equal for a sale to be consummated. When the offer price is less than the bid price, a sale is consummated at a price midway between the bid and adjusted offer price.
use in making these telephone calls.

Under each of these proposals, the names of both the buyers and sellers would be withheld from the other party until after a sale was consummated. In addition, the proposals designed to handle shell eggs and slaughter hogs included plans for a fixed premium-discount schedule in dealing with commodity quality which deviates from that specified by the standard contract.

In light of this basic overview of the computerized exchanges, I shall now individually examine the three exchange proposals and the main characteristics or features which vary from those described above in the overview.

2. Recently proposed computerized exchanges

a. Schrader's electronic egg exchange

The first proposal utilizing the computerized bid-offer matching format was that made by Schrader, Heifner, and Larzelere, in 1968 [23], to accommodate nationwide wholesale trading in shell eggs. The Schrader proposal envisioned the use of touch-tone telephones by member traders in gaining direct access to the exchange. Small-volume or nonmember traders would be allowed to access the exchange indirectly through commodity brokers much as is done in trading on a commodity futures market. Participating commodity brokers would be members of the exchange and have a teletype connection with exchange headquarters.

One of the distinctive features of the Schrader proposal was its two provisions for consideration of the transportation costs between trading zones. First, the individual could enter a transportation cost adjustments schedule which would designate alternative zones where he would be willing
to make the alternative zone acceptable. [23, p. 22] While this mode of compensating for transportation costs was included by itself in other proposals, only the Schrader proposal combined it with a second mode. The second proposed mode would permit carriers to offer their transportation services on the exchange. [23, p. 22] The trucking firm could enter a transportation offer by contacting their broker and specifying the desired origin, destination, number of lots that could be hauled, possible delivery date, and the per unit transportation charge. [23, p. 22] Upon the broker's entry of this data into the exchange computer, a new offer for each outstanding offer in the origin zone would be made in the destination zone at a price equal to the sum of the base offering price per unit plus the per unit transportation cost. [23, p. 35] In addition, for each egg bid at the specified destination zone, there would be a new bid in the carrier's origin zone equal to the destination zone bid price less the per unit transportation cost. [23, p. 34] In essence, the result of permitting the transportation service offers is to establish a file of standing transportation service offers between zones. One effect of this double transportation feature is to lessen the likelihood that the difference between the prices offered in two zones will exceed the cost of transportation between the two zones.

Rather than require federal grade certification on all lots traded, Shrader’s proposal would give buyers the option to call for inspection of any lot delivered. [23, p. 21] The cost of such inspection would be borne
by the buyer if the eggs meet the represented grade, and by the seller if the product failed to meet the represented grade requirements. [23, p. 21] When a lot did not meet the specified grade, sellers would also have the option of rejecting the lot or negotiating an appropriate discount. [23, p. 21]

b. Holder's computerized forward contract market for slaughter hogs

In 1972, Holder [12] published a proposal for a nationwide computerized slaughter hog exchange which also utilized the computerized bid-offer matching format. The Holder proposal called for the forward trading of standardized contracts. While immediate delivery contracts would be traded on the exchange making it in effect a "spot" market [12, p. 17], Holder envisioned trading in contracts for delivery up to two or three months after the date of sale. To allow for a producer's uncertainty as to the exact date his hogs would be at the most profitable slaughter weight, Holder proposed the specification of one, two, and four week delivery intervals, which would correspond to forward contracts sold one, two, three, or more than three months in advance of anticipated delivery. As the delivery interval approached and the exact date of delivery became more apparent, the producer would then be allowed to contact the purchasing packer and make an exact "delivery appointment," on a first-come-first-served basis. [12, p. 26] The contracts traded would be standardized in that the only variable terms of sale would be the number of head \(^{19}\) and the base price, which would be determined by the bidding on the exchange. [12, p. 33] To allow for

\(^{19}\) Holder said the number of head should be allowed to vary between 30 and 500 head. [12, p. 24]
death loss or other uncertainties, Holder's standardized contract would permit a five percent deviation in the number of head actually delivered from the number specified in the contract. [12, p. 24-25]

Because this electronic exchange will preclude visual inspection and force the buyer to rely on a written description and carcass evaluation of the hogs [12, p. 19], a premium-discount schedule was felt necessary to account for carcasses not meeting or exceeding the contract specifications. After talking to packers, Holder found much interest in having the premium-discount schedule reflect the carcass's value. However, due to the need for standardization in the contracts traded, Holder concluded that the schedule would have to be standardized. [12, p. 23] In order to satisfy packer desires that quality price differentials reflect changing market conditions, Holder found that it would be necessary to allow the premium-discount schedule to be changed between four and twelve times per year. [12, p. 23]

Holder further proposed that the premium-discount schedule for a particular delivery interval not be fixed at the time of sale, but rather remain undetermined until the time of delivery. [12, p. 32] In an attempt to eliminate the subjective evaluation which arises when carcasses are evaluated on a carcass grade and weight basis, Holder's proposal also called for evaluating carcasses solely on the basis of measurable carcass characteristics. [12, p. 31]

As in Schrader's egg exchange, the centralized trading computer in Holder's proposal would make automatic transportation adjustments by calculating the transportation and shrinkage costs associated with hauling hogs between trading zones. Thus, before attempting to match a producer's offers with bids, all bids would be adjusted for transportation and shrink-
age costs so that bids in more distant zones would be on a comparable basis with the bids from packers in zones nearer the producer's zone. [12, p. 29]

The Holder proposal would leave the decision of the actual sharing of delivery costs to the purchasing packer and the selling producer. [12, p. 28] Holder's proposal would also allow for the operation of one central assembly yard in each of the 100-400 trading zones in the thirteen North Central states. [12, p. 23] A packer could use the assembly yard by directing producers within the trading zone to deliver their hogs to the yard. Approximately 175-200 hogs purchased by one packer from several producers could be assembled at the yard and loaded on a three-tier semi-trailer. [12, p. 29] While this plan would require the additional expense of operating the assembly yards and the extra handling associated with unloading and reloading, Holder felt that this expense might be offset by savings arising from the economies to scale associated with larger trucks and long-distance transportation. Unlike the situation with the Ontario teletype auctions, redundant transportation under Holder's proposal would be unlikely because hogs would not be transported to the assembly yard until after a sale was consummated and the animals' ultimate destination known.

c. **Henderson's electronic feeder calf exchange**

In 1974, Henderson proposed a computerized bid-offer matching exchange for the marketing of feeder cattle raised in the United States. [11] The Henderson proposal grew out of concern over three problems: 1) the problems of price coordination between feeder calf producers and feedlot operators and the accuracy of signals communicated to feeder calf producers as to the quality and timing of their production; 2) the inefficiencies in the physical assembly and transportation between the feeder calf producer and the feedlot; and 3)
the lack of competitive bidding in the Ohio decentralized feeder cattle auction markets. [11, pp. 1-2] In Ohio, Henderson notes that these problems were enhanced by the characteristics of the Southeastern Ohio feeder calf production area, which is dominated by comparatively small, geographically dispersed production units. [11, p. 2] By linking feeder cattle producers (sellers) and feedlot operators (buyers) through the use of a telephone and computer network substantially similar to that employed by Shrader and Holder, Henderson hoped that his proposed exchange would resolve all three of these problems. For example, the price coordination and clarity of signals could be enhanced by improving the flow of marketing information in the industry. By utilizing the electronic computer to monitor all trading, the computer could readily be programmed to compile and report price summaries on trades occurring in recent periods. [11, pp. 4 and 13] Then, by connecting the computer to the network of producer touch-tone telephones the communication system could readily disseminate continuously updated information on the supply and demand situation to all feeder calf buyers and sellers. [11, p. 3]

Henderson's proposal also allowed for the making of adjustments in the bid and offer prices for necessary transportation costs to reach what he called "freight equalized prices." [11, p. 7] Under this proposed system, all buyers would receive price quotations on a "delivered basis," meaning that the seller's offer was adjusted to reflect the cost of delivery to the potential buyer's feedlot. [11, p. 8] In a somewhat similar fashion all prices quoted to sellers would be on the basis of "calves delivered to their local zone assembly point." This reflects Henderson's plan which would utilize a designated assembly point in each geographical production zone to
which the seller-producer could deliver his calves after receiving confirmation of their sale. [11, pp. 7-8] Henderson included the assembly function in his proposal to enable the organization of calves into efficient-sized shipping units. [11, p. 8] In addition, all calf weights could be verified at the zone assembly points. [11, p. 8] However, Henderson's proposal apparently does not allow participants to submit their own transportation cost figures for use in making the freight adjustment, but instead uses one standardized set of cost figures representing the transportation cost between every assembly point and every possible delivery zone. [11, p. 8] Once a trade is consummated under Henderson's proposal, the computer would automatically determine the most efficient method of assembly and accordingly issue delivery instructions to each party to the trade. [11, p. 14]

In the previously discussed computerized bid-offer matching exchanges the quality of the saleable commodities (i.e. eggs and slaughter hogs) was readily determinable as part of the buyer's processing activities. Henderson's proposed feeder cattle exchange differs from Shrader's egg exchange and Holder's hog exchange in that feeder cattle are not slaughtered upon delivery to their buyer. [11, p. 5] Thus, some means of evaluation besides post-sale grading was necessarily incorporated into Henderson's proposal to allow for deviations in commodity quality. Henderson furthermore recognized that feedlot operations are often organized for feeding a certain quality of calf. He thus concluded that there would be a need for presale grading of the calves on the farm where produced, by an impartial grader from either the United States Department of Agriculture or the state agricultural department. [11, p. 10] The calf grader would report the results
of his evaluation to the exchange's market agency headquarters, where it would be included in the lot description given to each potential bidder.

[11, pp. 9-10]

E. Summary

Having now completed an overview of three types of electronic commodity exchange systems and various attempts to put the systems into operation, certain weaknesses in the various exchange systems should now be readily apparent. Perhaps the most evident weaknesses in the prior proposals include the erratic interlot price fluctuations characteristic of the teletype auctions, the lack of market-determined quality price differentials between carcass grade and weight categories, and the failure of the exchanges to provide for more than one trading basis. Furthermore, it should now be evident that while one exchange system may be superior in several ways, it may be grossly inferior to another exchange system in other aspects. The issue then arises: How can one electronic exchange system objectively be compared with another? In an effort to resolve this issue, I have attempted to develop a set of evaluative criteria suitable for analyzing the desirability of the previous and future electronic exchange system proposals. The initial step in the criteria formulation, the identification of marketing system flaws, is presented in the following chapter.
III. FLAWS IN PRODUCER-PACKER EXCHANGE SYSTEMS

A. Introduction

Introduced in this chapter are twenty potential flaws in the present and proposed producer-packer slaughter cattle exchange systems under consideration in this study. These flaws or undesirable attributes have been identified because their existence prevents an exchange system from becoming effectively competitive. It is intended that these flaws serve as guidelines in the design of my proposed Electronic Simultaneous Progressive Slaughter Cattle Auction (ESPSCA) in Chapter IV and as the basis for the development of twenty evaluative criteria in Chapter V. Because these flaws are to be eventually used in developing a set of market criteria, my identification of flaws has drawn heavily from Sosnick's [26] ideas for the development of market criteria.

1. Portion of the cattle marketing process examined

The total cattle marketing process may be considered to entail those operations performed between the time cattle in the feedlot approach market weight and the time the resulting meat reaches the consumer's table. By necessity, I have limited the scope of my study to a portion of the total process which I refer to as the "producer-packer slaughter cattle exchange system." This "system" and thus the scope of this examination is defined by constraints on two dimensions of the marketing process: the physical dimension and the pricing dimension.

The physical dimension of the producer-packer slaughter cattle exchange system focuses on the physical transportation and handling of cattle from the time they attain market weight in the feedlot until they arrive at the
place of slaughter.

The pricing dimension of the producer-packer slaughter cattle exchange system concentrates on the determination of the exchange price which is received by the selling feeder and paid by the purchasing packer.¹

2. A desirable market format

I think that a desirable market in a free enterprise economy should provide producers and packers the choice of utilizing numerous alternative marketing methods. While the inherent flexibility of this market format should give producers and packers the opportunity to select the lowest-cost marketing method, required utilization of an allegedly efficient, lowest-cost method should be avoided. Furthermore, I think that the cost savings associated with selection of the lowest-cost method should be reflected in the marketing charges paid by those producers and packers utilizing it. Given this flexible market format, the interaction of rational market participants with the incurrence of profits and losses should eventually result in the utilization of the most efficient marketing method.

As presented by other economists [3, pp. 13-15; 26, p. 827], I believe that this flexible market format is most fully embodied in the concept of "effective competition." Effective competition is defined as the socially desirable and realistically attainable market system. Although primarily based on the concepts of the theoretical ideal - "perfect competition," effective competition attempts to avoid the realistic infeasibilities of

¹This definition of the pricing dimension carefully excludes from the scope a determination of "net" price received by the producer and the "net" cost of the cattle to the packer, which could become an issue in the event that either or both of the traders have hedged the cattle.
perfect competition. Thus, effective competition recognizes the potential offsetting advantage of economies of scale and restricted entry, and the impossibility of attaining a state of "perfect" information. Due to its realism, it is proposed as an improved standard of comparison against actual functioning markets.

Effective competition is attained when a particular market maximizes the collective gains from exchange incurred by the buyer and seller. Alternatively, effective competition may be defined as being attained when "for a set of perspective buyers and sellers at an assembly point, the ratio of actual to potential gains from trade are maximized." [25, p. 114]

3. Objective of flaw identification

As a marketing economist, it is my job to identify and propose the removal of barriers to efficient trade such as factors which cause price rigidities, price distortions, waste of valuable resources, or reduced producer marketing alternatives. Thus, the objective of my set of flaws is to identify undesirable attributes which prevent the attainment of effective competition by slaughter cattle exchange systems.

B. Standards for Market Criteria

In my identification of flaws, as well as my development of market criteria in Chapter V, I will attempt to conform to the standards for market criteria suggested by Sosnick. [26] That is, I will be "specific about the issues, definite about my own views, explicit about whether desirable conditions are attainable, discriminating in judging between a condition and its effects, comprehensive in listing market deficiencies, and stringent in describing my ideal." [26, p. 827]
1. **Necessary and sufficient conditions**

Pursuant to Sosnick's explicitness standard [26, pp. 830], I have formulated necessary and sufficient conditions for effective competition. Necessary conditions relate required specifications, while sufficient conditions indicate the circumstances that will merely suffice in creating an effectively competitive market.

Under my standards, the necessary conditions for effective competition are that each flaw be absent from the market. Accordingly, the market satisfies my sufficient condition for effective competition only if it is devoid of all the listed flaws.

2. **Realistic criteria**

In an attempt to attain what Stigler has called "operational criteria capable of being applied concretely . . ." [27, p. 504], I have restricted my necessary conditions for effective competition to those which I believe a slaughter cattle market can fulfill and whose achievement can be objectively ascertained. Satisfaction of many of the criteria require remedial adjustments or the elimination of ineffective conditions - conditions considered avoidable had expedient changes previously been made in exchange personnel, organization, policy, or regulation.

3. **Compliance with Sosnick's other standards for market criteria**

In an effort to satisfy the remainder of Sosnick's standards for market criteria [26, p. 828], I will take the following actions.

In an attempt to be "specific" I will identify twenty areas in the pro-

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2 This is an attempt to satisfy Sosnick's "realistic" standard. [26, pp. 830-32]
ducer-packer exchange system that need attention. Designating these areas as "flaws," I will specify them as the factors which determine whether a market is effectively competitive.

To satisfy the "definite" criterion, I will attempt to precisely state my criteria and substantiate each criterion with illustrative examples such that the reader may clearly resolve the question of whether a particular market is effectively competitive.

By classifying the exchange system flaws as either "undesirable in themselves" or "undesirable in themselves and due to their adverse effects," I will attempt to "discriminate" between the reasons why I believe the flaws create ineffective competition.

To comply with Sosnick's "comprehensive" standard, I have tried to prepare an all-inclusive list of necessary conditions for effective competition. This list attempts to identify all of the kinds of deficiencies that would create inefficiency in a producer-packer cattle exchange system.

In being "stringent," I have withstood the desire to moderate my necessary conditions for effective competition so that I can designate a certain market as being effectively competitive. Included in this is a resistance against lowering standards just so that my proposed electronic cattle exchange can be deemed desirable. Instead, I believe that my proposed exchange, if inefficient in design, should be identified as such now, before

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3 Although I present this list as a comprehensive set of slaughter cattle market flaws, I realize that it may be impossible to formulate an all-inclusive list of market flaws. Readers may want to add further flaws - and they should be encouraged to do so. Furthermore, other economists may believe that my flaws are correct, but that my arguments are wrong. These readers too should be encouraged to correct my reasoning as further understanding of marketing system efficiency is attained.
further research is done in this area.

4. Subdivision of the producer-packer flaws

For the purposes of organizing the set of flaws which follow I have divided the producer-packer exchange system into two sub-systems: 1) the assembly system - pertaining to the physical movement of cattle from the feedlot to the slaughterhouse; 2) the transaction system - pertaining to the interaction of willing buyers and sellers to determine the price of the fed cattle commodity. Accordingly, my list of criteria is divided into two areas of concern; 1) flaws in the assembly system, and 2) flaws in the transaction system.

The listing of each flaw is accompanied by a brief discussion and several examples of the ineffectiveness created by the particular flaw. In addition, I indicate whether the flaw is with respect to the market conduct, market performance or market structure.

C. The Flaws

1. Conditions precluding an effective assembly system

Listed below are two categories of flaws in the physical assembly of the live cattle:

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4 The transaction system is defined such that the physical presence of the live cattle is not required for exchange price determination.

5 Flaws in the assembly system reflect operational inefficiencies, while flaws in the transaction system indicate exchange inefficiencies.

6 I have excluded from the scope of my examination all aspects of market structure (i.e. location and concentration of buyers and sellers, product differentiation, etc.) except that pertaining to the regulation of the exchange. In this study my intent is to propose an improved exchange system by concentrating on the market conduct and performance and thus taking the nonregulatory aspects of the present market structure as exogenous variables.
slaughter cattle. Elimination of these flaws would allow for substantial savings in cattle marketing and procurement costs. Because the adversity of these flaws rests with extra costs and the wasteful allocation of resources, they pertain to market performance. Both categories of flaws are undesirable in themselves and their adverse effects.

a. Assembly of cattle at central yards is required  

Assemblage of cattle at terminal markets, auction barns, buying stations, or pooling yards causes redundant transportation, unnecessary livestock handling, nonproductive livestock facilities, and excessive transaction, marketing, and procurement costs.

1) Redundant transportation  

Marketing through intermediaries such as terminal or auction markets frequently precludes direct transportation routing. Consequently, cross-hauling results in the additional incurrence of the following unrenumerative costs: fuel consumption, driver's wages, truck depreciation, highway wear, cattle shrink, animal bruising, and insurance against highway accidents.

2) Nonproductive facilities  

Associated with auction and terminal markets, buying stations, and pooling yards are acres of cattle pens, sets of scales, numerous loading and unloading chutes, and countless buyer offices. In many cases, these facilities duplicate what is already available at feedlots and cattle packing plants.

3) Unnecessary handling  

Not only does excess handling in-

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7 For example, redundant transportation occurs when a cattle feeder near Des Moines, Iowa (Central Iowa), ships fed cattle to a terminal market at Omaha, Nebraska (Eastern Nebraska), only to have the cattle purchased for slaughter in Cedar Rapids, Iowa (Eastern Iowa).
crease labor charges and facility requirements, but it also increases bruising, shrink, disease transmission, and the potential for death loss. Ideally, the marketing system should allow producers the option of utilizing direct farm-to-packer shipments which eliminate assembly points.

4) **Excessive transaction and marketing costs** The cost incurred in anticipation of exchange such as commission firm charges, auction charges, and consignment fees, are often excessive. Ideally, producers should have the option of selecting marketing methods for which the cost in anticipation of exchange does not exceed the essential cost of matching potential buyers with willing sellers such that the collective traders' gain from the transaction is maximized.

b. **Packers not allowed to reduce procurement costs** Marketing methods requiring packers to field a crew of buyer representatives or not allowing packers to plan a uniform delivery of cattle at plants result in unnecessary expenditures and the inefficient use of resources.

1) **Costly search for cattle** Maintenance of centralized cattle markets and direct marketing channels do not allow packers to select less costly alternatives in purchasing cattle. To procure cattle at centralized markets, packers must have buyer representatives available to negotiate prices with producer agents. In the direct procurement process, packers must field a crew of buyers to locate and evaluate available cattle.

Not only may packers have to incur the cost of training the buyers, but

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8 For my purposes, cattle procurement may be defined as a reoccurring packer function which encompasses the packer's efforts to locate available cattle, commencing when he first recognizes the need for cattle and continuing until the cattle arrive at his plant.
they may also have to provide them with a car, an office, and absorb the cost of inaccurate quality estimates made by the buyers. Sometimes, the direct procurement process necessitates the maintenance of local buying stations.

Besides requiring the presence of buyers, auction markets may squander buyer time by using progressive auctions rather than the more expedient regressive ("Dutch") auction.

In contradistinction to the centralized and direct marketing channels criticized above, a system which relies on carcass grading to determine the price paid on cattle and producer initiative to indicate available cattle eliminates the need for maintaining a large team of cattle buyers, and thus provides a less costly procurement alternative.

2) Uneven delivery of cattle at plants

Maintenance of centralized cattle markets and direct marketing channels do not allow packers to plan for a uniform delivery of cattle at plants. Uneven cattle delivery exists when during each week daily cattle receipts are not correlated with daily slaughter capacity. This nonuniform cattle delivery causes unnecessary packer carryover costs and incomplete utilization of the packer's

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9 "Carryover cost" may be defined as the cost incurred when cattle are delivered prior to the day of slaughter.
human and capital resources. 10

This flaw is generally alleviated when feeders and packers contract cattle on the basis of a particular day's price with provisions for delivery on a specified future date.

2. Conditions precluding an effective transaction system

Included in this section are five distinct flaw categories each of which contain several major transaction system flaws. Because these flaws correspond to exchange inefficiencies that prevent the optimal matching of buyers and sellers such that their mutual gain is not maximized, they may be said to restrict effective competition in slaughter cattle markets. The five flaw categories concern: lack of trader prerogatives, the unavailability of adequate information to traders, misregulation of trader interaction, unsatisfactory transaction outcomes and the infeasibility of implementation.

10 Ideally, the procurement problem cited by Johnson [15, p. 35] should be avoided. In his report, Johnson reveals the inefficiency incurred in terminal marketing where most of the cattle are purchased early in the week for later slaughter. Data referred to by Johnson indicate the following daily purchase and kill trends for cattle marketed through terminals.

<table>
<thead>
<tr>
<th>Percentage of Week's Purchases Made Each Day</th>
<th>Percentage of Week's Kill On Each Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday: 34.4%</td>
<td>Monday: 18.4%</td>
</tr>
<tr>
<td>Tuesday: 29.3%</td>
<td>Tuesday: 19.4%</td>
</tr>
<tr>
<td>Wednesday: 21.2%</td>
<td>Wednesday: 19.8%</td>
</tr>
<tr>
<td>Thursday: 10.9%</td>
<td>Thursday: 19.5%</td>
</tr>
<tr>
<td>Friday: 4.0%</td>
<td>Friday: 18.2%</td>
</tr>
<tr>
<td>Saturday: 0.2%</td>
<td>Saturday: 4.7%</td>
</tr>
</tbody>
</table>

mentation. All flaws in the first three categories and the fifth category represent defects in the regulatory aspect of market structure. Flaws in the fourth category are associated with unsatisfactory market performance.

a. **Lack of trader prerogatives** In this category of trader prerogatives I include two flaws which result from the failure to allow traders pertinent decision alternatives in the transaction process. As stated previously, I believe that a desirable market format allows a trader as much flexibility as can be financially justified without advocating his infringement upon other traders' rights. Not only does a flexible market format permit traders to select the method that maximizes their collective gain, but it also complements an American tradition of free choice.

The current market organization and marketing policies frequently preclude cattle trading on a carcass merit basis¹¹ and do not allow producers an opportunity to refuse bids or withdraw their sales offerings without incurring excessive costs. Not only are these flaws undesirable in themselves, but they may also generate price distortions which adversely effect the price coordination of the entire cattle industry.

¹¹"Carcass merit basis" refers to a livestock sales arrangement under which the net price paid to the producer is founded on a predetermined base price in dollars per hundredweight and a standard carcass quality. By way of a visual examination (i.e. looking for the degree of marbling and conformation) and physical measurement (i.e. backfat (inches) and rib-eye size (square inches)), the individual carcass is compared with the standard carcass criteria and therein assigned a quality grade. Accordingly, the base price is adjusted by the premiums and discounts (in dollars per hundredweight) associated with the quality rating. The resultant adjusted base price becomes the price (in dollars per hundredweight) paid to the producer.
1) Traders not allowed to select price basis

Failure to allow cattle market participants the option of trading on either the live basis or a carcass merit basis acts as an unjustifiable restraint on effective competition by precluding a potentially more profitable alternative. Similarly, the absence of an option allowing traders to use either a rigid\(^{12}\) or a market-determined quality price differential schedule results in an unwarranted limitation on the trader's decision making process.

a) Live basis pricing not available

Traders should have the opportunity to exchange cattle on a live basis. Live basis trading would be advantageous to packers that desire to avoid the cost of grading carcasses associated with carcass merit purchases. This would be especially true if a packer has an established outlet that is thoroughly familiar with the packer's quality standards and does not require graded meat. Similarly, a packer's outlet may not require premium quality beef. Such an outlet would give a packer little incentive to pay the necessary premium for choice or prime cattle required with the carcass merit method. On the other hand, a producer may be skeptical of carcass merit sales methods and prefer to sell on a live basis.

\(^{12}\)"Rigid quality price differential schedule" refers to a premium-discount schedule used in adjusting the base price under carcass merit basis cattle sales arrangements. The incremental premiums and discounts associated with the incremental quality grades are determined by precedent, government regulation, the industry leader, or the individual packer. The schedule is termed "rigid" because the same scale is used on each producer's lot of cattle.

The rigid schedule may be contrasted with the "market-determined quality price differential schedule" where a different premium-discount increment scale is determined by bidder interaction for each lot of cattle.
b) Carcass merit pricing not available  

Due to the inherent disguise of hair, skin, bone, mud, and fat, live animal pricing cannot yield a consistently accurate evaluation of beef carcasses. Incorrect live quality estimates result in overpayments to producers for inferior quality and insufficient compensation for superior quality. This inequity garbles the transmission of pricing information and deflates packer profits.

c) Market-determined quality price differential schedule not available  

Traders should be allowed the option of having competitive market interaction determine the price differentials between good, choice, and prime quality carcasses. Likewise, a market-determined premium schedule for the various cutability ratings should be available.

Quality price differentials should reflect the added resale value to packers of higher quality carcasses based on the consumers' indicated willingness to purchase superior quality retail cuts. The use of rigid price differentials separating the incremental yield grades, quality grades, and carcass weight categories established by precedent, government regulation, or the industry leader, rather than flexible differentials determined by

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13 Given the present state of technology, pricing accuracy is maximized by evaluating cattle on the basis of carcass merit, using the following measurements: 1) untrimmed carcass weight, 2) U.S. carcass quality grade, and 3) U.S. carcass yield grade. [15, p. 27] Not only does carcass evaluation provide the basis for a more equitable evaluation of the producer's cattle, but it also emphasizes the production of quality beef and makes producers directly accountable for their product

14 Market-determined quality price differentials would be expected to be especially advantageous for producers of higher quality beef and packers whose outlets demand choice and prime quality meat.
competitive market interaction, may not accurately reflect the packer's incremental resale value.

To participate in competitive bidding for grade premiums a packer would be forced to calculate the maximum value he can justify paying for higher quality cattle. Consequently, it would be expected that the market-determined premium schedules reflect the actual value of higher quality cattle. Hence, the resulting price information available to cattle producers should be more accurate.

d) **Rigid quality price differential schedule not available**

Despite the advantages offered by market-determined quality price differential schedules, traders should have the option of utilizing a rigid quality price differential schedule. By making the rigid schedule an available alternative, the traders, rather than some arbitrary market official, are allowed an opportunity to weigh the costs, risks, and informational value of market-determined quality price schedules against the convenience, certainty, and price distortion attributes of rigid schedules. Furthermore, the availability of a rigid quality price differential schedule enables traders who do not favor the market-determined schedule to continue trading cattle on the basis of carcass merit, rather than leaving live basis trading as their only alternative.

2) **Feeders may not refuse packer bids without incurring excessive costs**

Packers and feeders should have equal bargaining power.\(^{15}\) To maintain equal bargaining power a feeder should be allowed the option of

\(^{15}\) "Equal bargaining power" refers to "the inability of a buyer or seller to influence prices by artificially restricting supply or demand." [15, p. 41]
refusing packer bids without incurring excessive costs. If this option is not available, the offering feeder may not be able to justify refusing what he considers to be an extremely low bid. Accordingly, packers may be able to force prices down on cattle delivered to centralized markets. Conversely, the availability of this option equalizes producer-packer bargaining power because it permits the feeder to refuse the low bid and defer sales until another day.

When evaluating producer bargaining power, the question may be asked: Are the cattle sold while still in the producer's feedlot? If the answer is "no," the evaluator should recognize the potential loss associated with refusing a bid price once cattle have been delivered to an assembly point, auction yard, or terminal market.

b. Unavailability of adequate information to traders In order to make the optimal trading decision each trader needs to be provided with a complete set of market information which reveals the available marketing decision alternatives. Insufficient information precludes those alternatives of which the participant is unaware. Although I doubt that a "perfect set of information" is a realistic goal, I do believe that certain market policies and organizations render a more comprehensive coverage of market information.

Not only is accurate and complete information of pricing trends needed,

16 Costs of refusing a bid may include: cost of hauling cattle home from the centralized market, additional yardage if the cattle are held overnight for sale on the following day, and death loss.

17 The optimal trading decision results in an efficient exchange outcome which maximizes the traders' collective gains.
but the information system needs to provide a rapid disclosure of competing bids without necessarily revealing the bidders' identities. Furthermore, all bidders should be able to bid on each lot of cattle offered.

Uncomprehensive market news not only has undesirable characteristics in itself, but also produces the unfavorable effects resulting in inaccurate pricing. Not only does the incomplete disclosure of competing bids hinder pricing accuracy, but it also complicates trader decision making. Failure to allow all potential bidders to bid on each lot poses no fault in itself, but does promote adverse pricing behavior. Although the revelation of trader identity may appear to have no significant effect in itself, it does facilitate packer collaboration and predation.

1) Inadequate market information A marketing system should be adaptable\textsuperscript{18} to an operative method of providing comprehensive market news to all traders. Restrictions on the coverage or accessibility of commodity market news promote an inequitable distribution of market information,\textsuperscript{19} resulting in inefficient exchange.

Unfortunately, inadequate market news more severely penalizes the smaller producer or packer that feels he can not justify the purchase of additional market information. Conversely, larger participants, who believe the benefits to be gained by acquiring additional information exceed the costs, will enhance their bargaining positions by hiring informants, observ-

\textsuperscript{18}Due to the centralized location of transaction decisions, terminal or auction markets would be expected to be more adaptive to complete market news reporting.

\textsuperscript{19}As used in this chapter the term "market information" encompasses statistical and market data such as exchange prices and trading volumes.
ers, and market analysts. Although these larger traders maximize their gain from trading, the inadequate knowledge status of the smaller participants results in inefficient exchange because it precludes the maximization of collective gains.

2) Competing bids not rapidly disclosed

Failure to provide complete and rapid disclosure of competing bids complicates the traders' decision making processes and reduces the competitiveness of the transaction system by reducing the flow of pricing information. This information deficiency precludes the attainment of a trade which maximizes traders' collective gains (i.e. the optimal trade), thus resulting in inefficient exchange.

Restriction of bid disclosure reduces the competitiveness of the market by precluding sales to higher but unknown bidders. Insufficient bid information also complicates the market decision-making process by forcing the producer to assume that he has received a bid comparable to those which he could have obtained from other buyers. Only with additional knowledge can this assumption be verified. Thus, the information scarcity may lead producers into buying information through various informants. However, such purchases of information impose an inequality upon smaller producers who can not afford the expenditure.20

It should be noted that the decentralized nonauction marketing methods and the centralized terminal marketing method are frequently characterized by their incomplete bid disclosure, whereas the auction market provides relatively good intramarket bid information.

20 A similar inequality may also be expected between large and small meat packers.
3) Not allowing all bidders to bid on every lot. Failure to allow all potential bidders to bid on every lot induces reduced competition and interregional price discrepancies in excess of transportation costs. Restricting the number of bidders that can bid on every lot, whether due to physical or spatial barriers, reduces price competition and ultimately may allow a few bidders to determine price.

Because bidding produces pricing information, bidder restriction limits information and thus precludes attainment of a true indication of the demand for cattle. Inadequate knowledge of demand strength may promote pricing patterns inconsistent with the actual demand situation.

Localized bidding promotes interregional price discrepancies in excess of transportation cost. This is especially true because decentralized procurement is more likely to preclude the optimal matching of buyers and sellers and may lead to price discrimination against producers in isolated areas.

4) Disclosure of bidder's identity required. Bidder's identity is one piece of information which should not be made available to competing bidders. Forcing the disclosure of a bidder's identity may promote packer collaboration to reduce competition or cause packer predation.21

5) Disclosure of seller's identity not optional. Revelation of a seller's identity allows packer-buyers to associate an otherwise homogeneous cattle commodity unit with a particular feeder's "production repu-

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21 Predation might involve packer collusion to drive a smaller buyer from the market. By always outbidding the small packer, the colluding firms could eliminate the small packer's cattle supply and/or make his cattle procurement cost prohibitive.
This reputational association is advantageous to sellers having favorable production reputations because it allows them to differentiate their product. Conversely, the reputational association is a detriment to sellers having unfavorable production reputations because it permits packer-buyer discrimination against their cattle. Accordingly, I think that effective competition is most greatly enhanced when sellers have the option of revealing their identity to all potential buyers prior to the commencement of the price determination process. By providing this option, sellers rather than an arbitrary market official are allowed to weigh the benefits against the detriments of identity disclosure in their particular circumstances.

Optional seller identity disclosure is superior to either compulsory anonymity or compulsory disclosure because it makes available the rewards for favorable producer reputation without totally depriving sellers of the protection from bidder discrimination afforded by seller anonymity. That is, when identity disclosure is optional a producer confident that he enjoys a favorable reputation may choose to reveal his identity to potential buyers in an attempt to reap the benefits of his reputation and ability to differentiate.

Upon disclosure of a seller's identity, a buyer who has had previous contacts or dealings with the identified producer may be able to recall the producer's "production reputation" and thereby formulate a set of anticipated product characteristics which either precludes the need for visual inspection of the cattle or enables the buyer to perceive more background information about the cattle than can be obtained from visual inspection alone. The term "production reputation" refers to the attributes of one's cattle production operation which may be ascertained through either personal association or feedlot visitation. These production attributes may include the producer's quality standards, (i.e. does the producer generally feed choice or good quality cattle), production methods (i.e. does the producer utilize an open feedlot or confinement facilities), cattle breed, herd health, production location, and the size of the production operation.
tiate his product. At the same time, a seller fearful that his reputation is unfavorable may seek protection from buyer discrimination by refusing to have his identity revealed.

Admittedly, disclosure of seller identity hinders the attainment of effective competition because not all buyers may have previous knowledge about the producer and his production characteristics. This incomplete distribution of information leads to an inadequate basis for making bids, which strongly disfavors those buyers with inadequate reputational knowledge. However, this hindrance of effective competition may be offset by the fact that the ability to differentiate one's cattle on the basis of one's production reputation encourages the maintenance of a favorable production reputation and thus the production of quality cattle. Furthermore, seller identity disclosure may partially substitute for a packer-buyer's need to visually inspect cattle prior to bidding.

c. **Misregulation of trader interaction** In order to maintain an equitable trading system, an explicit set of rules and regulations needs to be initially adopted by trading participants and the regulatory agency should be made responsible for its strict enforcement. Furthermore, the supervising agency and the participants need to establish provisions allowing for regulatory amendments when needed. Regulatory "action or inaction" that promotes transaction inefficiency constitutes misregulation of trader interaction.

Inaccurate grading systems and packer discrimination against producers are not only undesirable in themselves, but also produce adverse effects.

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23 The inequality of information distribution may force some buyers to needlessly purchase additional information.
Inaccurate grading systems elicit imprecise carcass evaluation, and thus cause incorrect payment to producers. Over a period of time, inaccurate grading systems may provide erroneous pricing signals to producers regarding the quality of cattle desired.

Packer collaboration is not objectionable in itself; however, mutual agreements may eventually lead to higher packer profits, reduced competition, and higher retail meat prices.

1) **Accurate grading system not optional** Failure to allow traders the option of utilizing grading systems which accurately reflect the relative quality of beef carcasses leads to an imprecise valuation of the commodity. This inexact grading yields overpayment for inferior quality and underpayment for superior quality, hence preventing the optimization of traders' collective gains. However, required use of any grading system is undesirable because the cost of conducting the grading may exceed the value of the grading accuracy to the traders.

2) **Undesirable packer collaboration is allowed** Lack of regulation or failure to enforce existing anticollusion regulation can only be construed as an encumbrance to equalized bargaining power and effective competition.

Undesirable collaboration may be defined as mutual agreement to cooperate that needlessly hinders market efficiency or aggressiveness, thereby acting as an impediment to effective competition. Unwanted collaboration may include arrangements to fix market prices, to pool profits, to assign procurement zones, to limit purchases or production, to restrict entry, or drive out smaller competitors. Collaborators may hope to gain added bargaining power by entering into conspiratory agreements. Accordingly, the
enhanced packer bargaining power may allow artificial manipulation of commodity demand and yield excessive packer profits.

d. Unsatisfactory transaction outcomes In this section of transaction system criteria my primary concern relates to the performance of the market exchange system. Conceptually, my goal is to determine "how nearly the ratio of actual to potential gains from trade has been maximized?".

[25, p. 114] But, instead of trying to establish a specific maximized-gains criterion, I focus on several price criteria in an attempt to determine the likelihood that the realization of potential transaction gains has been maximized through the maintenance of effective competition.

In this transaction flaw category, I introduce a criterion for lot-to-lot random price fluctuation and for excessive spatial price differentials. Flaws associated with these criteria are both undesirable in themselves and their effects. Unwarranted price fluctuation yields immediate producer price inequality, while at the same time causing producer disillusionment and dissatisfaction. Spatial price differentials in excess of transportation costs mean that abnormal prices are being received by some producers which may lead to an unwarranted locational shift in production. Moreover, this latter flaw is a symptomatic indication of inefficient, noncompetitive trade.
1) **Unwarranted price fluctuation**\(^{24}\) Intrasession lot-to-lot random price fluctuation to the extent that price changes do not reflect quality differences\(^{25}\) and/or buyers' diminishing interest in accumulating more units yields inequitable treatment of sellers, inefficient exchange outcomes, and an adverse division of gains. Additionally, interlot price fluctuation complicates the formulation of bidding strategies and makes pricing differences associated with quality, location, and time, more difficult to perceive.

2) **Persistent maintenance of interregional price differentials in excess of transportation costs** One overall evaluative standard of market performance proposed by Sosnick and others was "average prices for an essentially homogeneous commodity at spatially separated assembly points should not persistently differ by more than unit transportation costs, and should not persistently differ by less than that much if the commodity is actually shipped." [25, pp. 112-116]

Persistent violation of this standard might be interpreted as a symptom of inefficient, noncompetitive trade. The excessive price differentials do indicate an abnormally low (or high) price at one location when

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\(^{24}\) An interesting discussion on relative market price stability is presented by Preston and Collins. [19, p. 98] The writers suggest that relative price stability is necessary in obtaining the maximum benefit from the market scheme rather than another allocation mechanism. However, the authors caution that price flexibility must amply mirror changes in cost and demand if an effective market is to be maintained. Under this argument, price stability may be denounced as inefficient. Collins and Preston conclude by proposing a consolidation of these two lines of thought: "A market is efficient when cost changes are readily reflected in price changes, demand changes are reflected in volume changes, and random instability not associated with fundamental readjustments is at a minimum..." [19, p. 98]

\(^{25}\) Sex, weight, quality grade, and yield grade.
compared to several other market sites. More importantly, the excessive price differentials signify a possible barrier to competition in one locale which is preventing competitive bidding. One possible barrier might be an ineffective interregional market communication network. Another possible competitive barrier would be collusive attempts to restrain the entry of competing bidders. Or, the commodity may have an inherent transportation limitation (i.e. shrink or perishability) which hinders interregional transportation and thus causes the incurrence of transfer costs in excess of mere transportation costs.

e. **Infeasibility of implementation** In analyzing proposed commodity exchanges (i.e. those not presently in operation) it is desirable to additionally identify structural\(^{26}\) flaws which may hinder implementation of the exchange and/or make implementation impractical.

Flaws which may make implementation infeasible include required enabling legislation, a required uniform commodity grading system, and sophisticated trading rules.

These implementation flaws arise from requirements which may not only have undesirable characteristics in themselves, but also may adversely effect the implementation of the proposed exchange.

1) **Enabling legislation required** The implementation of proposed exchange systems which require the enactment of enabling legislation may be hampered by the inherent constraints of the legislative process. Such constraints are likely to delay, dilute, modify, or totally refute the

\(^{26}\) See footnote 6 regarding the scope of my analysis of structural flaws in exchange systems.
needed legislation and accordingly burden the proposed system's implementation.

Among the first legislative hurdles is the need to convince legislators of the interest in or need for the proposed marketing system in order to prove legislative priority. Even after it is scheduled for discussion on the legislative calendar, a legislative proposal must still obtain the consensus of a majority of the members of the legislative body that the proposal is worthy of enactment.

Enactment of the needed legislation will frequently be further hindered by a lack of legislator expertise in commodity marketing, consumer lobbyists who oppose producer-oriented legislation, and legislators who because of political necessity cater to the preferences of urban voters.

2) Establishment of a uniform commodity grading system required

Requirements that a uniform grading system for the commodity be established arbitrarily denies participants the opportunity to utilize alternative grading systems more ideally suited to their individualized needs. Furthermore, the cost of retraining commodity graders to implement the new grading system may exceed the cost savings arising from convenience and the value of the increased grading accuracy attained through use of the uniform system.

3) Sophisticated trading rules

The operational mechanics, administrative rules and regulations, and buy-sell transaction details must be relatively unsophisticated to enable rapid comprehension by feeders, packers, and market agency personnel. Trading rules that are so complex and detailed that the cost of learning the mechanics of trading or retaining exchange participants is greater than the potential return, restrict
participation by excluding those small cattle feeders or low-volume meat packers who can not justify the cost.

Additionally, exchange rules must be expressed explicitly and enforced judiciously, to insure an equitable administration of the exchange system.

D. Summary of Producer-Packer Exchange System Flaws

In summary, I have identified the following flaws as indicators of exchange inefficiency in the cattle assembly system:

1. Redundant transportation
2. Nonproductive facilities
3. Unnecessary handling
4. Excessive transaction and marketing costs
5. Costly search for cattle
6. Uneven delivery of cattle at plants.

Similarly, the existence of any one of the following flaws indicates that a slaughter cattle transaction system is inefficient:

1. Traders not allowed to select price basis
2. Feeders may not refuse packer bids without incurring excessive costs
3. Inadequate market information
4. Competing bids not rapidly disclosed
5. Not allowing all bidders to bid on every lot
6. Disclosure of bidder identity required
7. Disclosure of seller's identity not optional
8. Accurate grading system not optional
9. Undesirable packer collaboration is allowed
10. Unwarranted price fluctuation
11. Persistent maintenance of interregional price differentials in excess of transportation costs

12. Enabling legislation required

13. Establishment of a uniform commodity grading system required

14. Sophisticated trading rules
IV. DEVELOPMENT OF THE PROPOSED ELECTRONIC SIMULTANEOUS PROGRESSIVE SLAUGHTER CATTLE AUCTION

In view of the imperfections in prior electronic marketing system proposals, this research project was formulated with the objective of designing an improved and implementable electronic exchange for slaughter cattle fed in Iowa. Presented in this chapter is a development of the resultant electronic exchange proposal - the Electronic Simultaneous Progressive Slaughter Cattle Auction (ESPSCA).

The development commences with an evaluation of alternative transaction systems in an attempt to identify the one most suitable for use in my proposed exchange (Section A). The development then progresses with an abstract description of the selected simultaneous progressive auction transaction system (Section B). As the third step in the development of the ESPSCA, I proceed by adapting the basic simultaneous progressive auction transaction system for the sale of slaughter cattle fed in Iowa (Section C). In the fourth and final step of this development (Section D), I present the design of a system that will enable the simultaneous progressive slaughter cattle auction to be conducted electronically.

A. Selection of a Transaction System

The most fundamental component of any marketing method is its transaction system.¹ Thus, before commencing development of a new cattle marketing system, a theoretical examination of possible transaction systems should be

¹A "transaction system" is an institutional framework for exchange, as delineated by certain rules of exchange which serve as guidelines for and/or constraints on negotiations. [20, p. 46]
undertaken. After completing this comparative analysis, one transaction system must be selected which can be incorporated into an operational electronic exchange and which, when implemented, will facilitate maximization of exchange efficiency.

In this section nine transaction systems are identified. After narrowing the field to four auction-type transaction systems and examining an empirical study on auction exchange efficiency, the simultaneous progressive auction is selected for use in my electronic exchange proposal.

1. Available transaction systems

The economic price determination process may be undertaken by a number of different transaction systems, several of which are: auction, sealed bidding, collective bargaining, exchange, bazaar, and administered pricing. [20, p. 50] Each of these transaction systems is distinguished by certain characteristics which make it better suited for pricing particular types of economic goods.

2. Advantages of the auction transaction system

For the purposes of this investigation, I have limited my attention solely to the auction transaction system. I believe that auctions utilize a more open format which allows public and participant observation and thus yields an enhanced flow of information and increased exchange efficiency. The auction format distinguishes itself by permitting an organized, objective price determination involving numerous potential buyers for each individual saleable commodity unit. Unlike collective bargaining where buyers and sellers discuss price possibilities until an agreeable price arrangement is made by means of an unstructured agenda, auction rules specify the
exact procedure for price determination giving the auction an organized format. When auction rules require that bidders make successive incremental bids in order to outbid one another, auction format allows bidders to objectively determine commodity price with active knowledge of what the last bidder was willing to pay. By contrast, administered pricing and collective bargaining require subjective price determination based on supply and demand information, without actual knowledge of what other potential buyers would be willing to pay. Furthermore, the auction format permits the competitive interaction of numerous potential buyers in the determination of price for a single unit of commodity. By contrast, direct exchange limits the pricing participants to one buyer and one seller, and therefore precludes bidder interaction.

3. Identification of four auction transaction systems

For my investigation it is necessary to identify and discuss four auction transaction systems 1) the successive progressive auction, 2) the successive regressive auction, 3) the second price successive regressive auction, and 4) the simultaneous progressive auction.²

a. Successive progressive auction Being commonly used in livestock, art, and antique sales, the successive progressive auction transaction system is probably the most frequently used type of auction. The successive progressive auction is characterized by a specified sale order and disclosure of competing bids before the exchange price is finally determined. This auction transaction system is designated "successive" because individ-

²The discussion in this section draws heavily from Raikes [20, pp. 48-49].
ual units are sold consecutively, one after another, with a separate price
determination for each unit. In addition, this auction is designated "pro-
gressive" because during the sale of each individual item on the sale
agenda, the auctioneer starts the bidding at a price below the expected
sale price and permits it to rise as bidders successively make incremental
price bids. The last bidder, being the highest bidder, establishes the ex-
change price and becomes the buyer of the saleable unit.

b. Successive regressive auction transaction system  This auction,
also referred to as a "Dutch" auction, has been used successfully by the
Ontario Hog Producers' Co-operative in their slaughter hog teletype auctions.
Successive regressive auctions are characterized by a specified sale order
and nondisclosure of competing bids before the exchange price is finally
determined. The successive regressive auction transaction system is simi-
lar to the successive progressive auction transaction system in that units
are sold successively, one after another. However, the successive regres-
sive auction differs in that the auctioneer starts prices above the expected
selling price and prices are allowed to decline until a bid is entered. The
first bidder, being the highest bidder, establishes the sale price and be-
comes the buyer of the saleable unit.

c. Second price successive regressive auction transaction system
This auction proceeds in a manner similar to the successive regressive auc-
tion, with the winning bidder being the first person to bid. However, in
the second price successive regressive auction the price paid is that of-
fered by the second person to enter a bid.
d. Simultaneous progressive auction transaction system

Instead of selling individual units successively in accordance with a specified sale order as in a successive progressive auction, bids on all units to be sold during a particular simultaneous progressive auction session are received concurrently. All units are then sold simultaneously to the highest bidder on the individual units. As in the successive progressive auction, the simultaneous progressive auction transaction system does allow for incrementally higher bids and disclosure of competing bids prior to the time the exchange price is finally determined.

4. Selection of the most efficient auction transaction system

On the basis of research performed by Raikes [20], I have selected the simultaneous progressive auction transaction system over the other three auction transaction systems for use in my proposed exchange. The simultaneous progressive auction was selected in part because this auction's simultaneity element makes interlot relative price comparison possible during the pricing process. Furthermore, it is hoped that by incorporating the simultaneous auction framework into the cattle marketing process, the lot-to-lot price variability characteristic of the Ontario Hog Producers' Cooperative successive regressive auction and the successive regressive slaughter cattle auction proposed by Johnson [15, p. 70], can be avoided.

Raikes' research involved the construction of computer simulation models of the four auction transaction systems previously mentioned and a

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3 An "auction session" is the periodic time interval during which an auction is conducted. Each auction session begins with the initiation of bidding on units consigned for sale during the time period. The session continues throughout the duration of bidding on the consigned units and terminates when the last consigned unit is sold.
comparison of each auction's computed exchange efficiency with certain a priori expectations. Findings by the Raikes study with respect to auction exchange efficiency, auction price dispersion, and auction buyers' gain, were persuasive factors leading to the selection of the simultaneous progressive auction transaction system.

a. Auction exchange efficiency The Raikes analysis used "the ratio of the actual to the maximum attainable value of total joint payoff" as a measure of exchange efficiency. [20, p. 66] Raikes' empirical results showed that when homogeneous units are being auctioned, the four auction transaction systems are equally efficient. [20, p. 286] However, as expected, when heterogeneous units are being sold the simultaneous progressive auction is significantly more efficient than the three successive-type auction transaction systems. [20, p. 286]

Raikes credited the higher efficiency of the simultaneous progressive auction transaction system to the problems in bid strategy formulation incurred by buyers participating in the successive auctions. For example, successive auction bidders frequently erred in their anticipation of relative price levels and consequently purchased the wrong type of goods. [20, p. 318] By contrast, bidding strategy formulation under the simultaneous progressive auction transaction system is more straightforward and efficient.

The term "heterogeneous units" means that the quality characteristics of the different saleable units differ, although each member of the saleable unit is similar in quality.

Using a 0.95 significance level, Raikes determined that of the four auction transaction systems considered, the simultaneous progressive auction is the transaction system with the highest mean measure of exchange efficiency. [20, p. 285]

There was no significant distinction between the efficiency of the three types of successive auction transaction systems. [20, p. 285]
progressive auction transaction system is facilitated because the prices for all saleable units are determined at the same time with all bids being made available to competing bidders during the actual price determination. Accordingly, there is no need to anticipate relative price levels under the simultaneous progressive auction transaction system. Furthermore, simultaneous progressive auction bidders have no reason to bid high to purchase units auctioned early during the session in order to protect themselves against the possibility of even higher prices later in the auction session. [20, p. 121]

b. Auction price dispersion As expected, the simultaneous progressive auction transaction system yields a lower dispersion of prices when compared to the three successive auction transaction systems. Raikes indicated that the wide price dispersion associated with the successive regressive auction may be attributed to the fact that bidders must enter the first and highest bid in order to purchase a lot and they must pay the price they bid. Under these circumstances subjective judgements about what other bidders will bid are influential factors in the price determination process. [20, p. 123] Because the subjective anticipations change rapidly during the course of a regressive auction session, bids and price levels may also change quickly. [20, p. 123]

c. Auction buyers' gain The Raikes study empirically computed the amount of buyers' gain as "the ratio of the actual to the theoretically pre-

[7] Raikes noted that the availability of pricing information made possible by the "simultaneous" and "progressive" characteristics may also reduce stress on traders, resulting in an increase in the average efficiency of the exchange outcomes. [20, p. 101]
dicted payoff to buyers." [20, p. 68] According to Raikes' results, the simultaneous progressive auction transaction system yields larger gains to the bidder than the successive progressive auction transaction system. These gains are normally unobservable, even though simultaneous auction prices are not lower than successive progressive auction prices. The gains are credited to the relative uniformity of prices, the lack of wrong purchases frequently made without sufficient comparative pricing information in successive auctions, and monopsonistic bidder behavior in the simultaneous progressive auctions. Raikes described this later characteristic in the sense "that bidders will realize that the more units they try to buy, the higher their average costs will become. Thus, bidders will cease bidding when the expected gain from their last intramarginal unit becomes less than the expected increase in their costs." [20, pp. 123-4]

d. Simultaneous auction disadvantages Although believed to be out-weighed by advantages, the simultaneous progressive auction transaction system has several disadvantages which should be considered. In general, simultaneous auctions proceed at a slower pace than successive progressive auctions, resulting in a lower volume of units exchanged per unit of time. This reduced volume is partially caused by the large amount of time required for bidders to make relative price comparisons between the various units offered. Also, the Raikes study indicated that seller gains diminish when a large number of bidders simultaneously bid on a homogeneous commodity. [20, p. 322]

8Higher prices may be expected in the successive auctions as seriatum sale invites overbidding, especially in the initial portion of an auction session. [20, p. 124]
B. An Abstract Explanation of the Simultaneous Progressive Auction Transaction System

Before discussing applications of the selected simultaneous progressive auction transaction system in cattle marketing, the reader should become more familiar with the essential nature of the simultaneous progressive auction format. As has previously been noted, simultaneous progressive auctions are characterized, as well as distinguished from other auction transaction systems, by their unique combination of three trading features: 1) progressive bidding, 2) contemporaneous price determination for two or more saleable units, and 3) simultaneous sale⁹ of two or more saleable units.

To illustrate the role of these characteristics during the conduct of an auction session, I now present an abstract description of the preparatory, bidding, and closing stages of a simultaneous progressive auction.

1. Preparatory stage of a simultaneous progressive auction

In preparation for the conduction of a simultaneous progressive auction, all consigned lots¹⁰ are represented, either by their physical presence or

⁹ Because the sale of cattle between the producer and packer will constitute a sale of "goods," as defined by the Uniform Commercial Code, 554.2105(1), Iowa Code (1977), this auction sales transaction will be covered by Article 2 of the Uniform Commercial Code. Thus, wherever appropriate in this chapter, I will use the relevant auction sales terminology and definitions established by the Uniform Commercial Code.

The Uniform Commercial Code, 554.2106(1), Iowa Code (1977), defines the term "sale" as "the passing of title from the seller to the buyer for a price." Accordingly, in this paper the term "simultaneous sale" refers to the passage of title of two or more saleable units which occurs at the same moment in time.

¹⁰ The Uniform Commercial Code, 554.2105(5), Iowa Code (1977), states that "Lot" means a parcel or a single article which is the subject of a separate sale or delivery, whether or not it is sufficient to perform the contract." Thus, in the context of a simultaneous progressive slaughter cattle auction the term "lot" refers to a group of slaughter cattle which is the subject of a separate sale transaction.
physical description, at a centralized marketplace. If the saleable units are physically present, all potential bidders gathered at the marketplace are permitted to observe, examine, and evaluate each lot for sale.

2. **Bidding stage of a simultaneous progressive auction**

Upon completion of the preparatory period, the auction session begins, allowing bids to be entered contemporaneously on all lots. Each potential bidder in attendance has an equal opportunity to repeatedly enter incremental bids on each lot. The bidding on each lot is for the purpose of determining one price — the sale price (exchange price) of the particular lot. The current bid and the last bidder’s identification code on each lot is posted for viewing by all potential bidders on a bid tally device. Whenever a bidder desirous of purchasing a particular lot sees that his previous bid on the lot has been surpassed by bids from other bidders, he has the opportunity to rebid on the lot.

3. **Closing state of a simultaneous progressive auction**

The auction session closes when no bidder is willing to enter another bid on any lot. Upon the auctioneer's announcement of the auction's completion, title to each and all lots passes simultaneously to the last and therefore highest bidder on each individual lot. The sale price of each lot is the price of the last bid on the particular lot.

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11The Uniform Commerical Code, 554.2328(2), Iowa Code (1977), states that: "A sale by auction is complete when the auctioneer so announces by the fall of the hammer or in other customary manner."
C. Incorporating the Simultaneous Progressive Auction Transaction System into a Producer-Packer Exchange System for Slaughter Cattle Fed in Iowa

As the third step in the Electronic Simultaneous Progressive Cattle Auction (ESPSCA) development, I now present a description of a nonelectronic slaughter cattle exchange which utilizes the simultaneous progressive auction transaction system.

This section commences with a discussion of the necessary modifications which should be made in the basic simultaneous progressive auction transaction system rules in order to accommodate the marketing of slaughter cattle. Thereafter, attention is focused on the preparatory, bidding, and closing stages of the Nonelectronic Simultaneous Progressive Slaughter Cattle Auction (NESPSCA).

1. Necessary modifications in the simultaneous progressive auction transaction system rules

Rules of the basic simultaneous progressive auction transaction system have necessarily been modified to accommodate the following NESPSCA features: a) central assembly of cattle not required, b) organization of cattle into saleable "lot" units, c) multiple price determination, d) lot withdrawal, and e) at-feedlot bids.

a. Central assembly of cattle not required  Because central assembly of cattle for buyer examination and evaluation is physically inefficient, the rules of the NESPSCA should be modified to permit sale of cattle while they are still in the feedlot or at a regional assembly yard. As a partial substitute for presale bidder inspection, consignors will have the option of having their cattle graded prior to sale at either the feedlot or assem-
bly yard. When the grading option is elected, the grader's report will be made available to bidders prior to the auction.

b. **Organization of cattle into saleable "lot" units** For organizational purposes, any number of cattle from the same consignor, similar in quality and weight, and consigned under the same trading basis, may be grouped together to form one saleable unit called a "lot." All prices determined, as well as all exchange records, communications, and billings, will be with respect to this "lot" unit.

c. **Multiple-price determination** It may be recalled that in the abstract simultaneous progressive auction illustration (Section B) the commodity could be consigned on only one trading basis and only one price per lot was determined by bidders. In order to allow consignors the option of having their cattle priced under one or more alternative trading bases, and to accommodate the sale of cattle on a carcass grade and weight basis with market-determined quality price differentials, it has been necessary to modify these basic simultaneous progressive auction rules in order to permit the determination of more than one price for each lot.

To accommodate multiple-price determination it is first necessary to delineate the trading bases to be offered. Accordingly, I propose that the consignor be allowed to select one of three singular trading bases: 1) the

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12 The words "trading basis" refer to an arrangement for determining the amount to be paid to the seller. Terms which vary from one arrangement to the next include the time of determining the pay weight (i.e. before or after slaughter), and the amount and type of grading to be performed.
liveweight basis (L), 13 2) the "in the meat" basis (M), 14 or 3) the carcass grade and weight basis (C). 15 Alternatively, I propose that the consignor be allowed to select among one of four combination trading bases: 1) the higher of liveweight or "in the meat" basis (LM), 16 2) the higher of liveweight or carcass grade and weight basis (LC), 3) the higher of "in the meat" or carcass grade and weight basis (MC), or 4) the higher of liveweight, "in the meat," or carcass grade and weight basis (LMC).

Secondly, multiple-price determination requires the identification of one or more "lot components" for each singular trading basis. Each "lot

13 Under the liveweight trading basis the bid price is paid for each one hundred pounds of live animal sold, irregardless of the weight or quality of the resulting carcasses. Bids are usually entered after visual inspection of the cattle and accordingly are expected to allow for quality, weight, and sex characteristics.

14 Under the "in the meat" basis, producers are paid a price per hundredweight of hot beef carcass, irregardless of the carcass quality and yield grade. Bids received under this basis are to determine the price per hundredweight to be paid for steer and heifer carcasses.

15 Under the "carcass grade and weight" basis, different prices in dollars per hundredweight of hot carcass are determined for carcasses meeting various sex, yield grade, quality grade, and weight specifications. Ideally, the price differentials between the carcass categories reflect the difference in the value of the carcasses to packers.

After a producer's cattle have been slaughtered, each carcass is weighed and graded in order to determine the carcass category in which it falls. The bid price for each carcass category is then paid for all carcasses falling into the particular category.

16 When cattle are consigned under a combination trading basis, bids for the cattle will be received on the two or three singular trading basis which are included in the combination trading basis. After bidding on the cattle has ceased and before completion of the auction session, the auction officials will report the bid prices for his cattle under each singular trading basis. The consignor will then be given the opportunity to select the one singular trading basis which he feels will yield him the "highest" net price. Upon designation, the selected trading basis becomes the consignor's "exchange basis."
"component" represents a specific trading basis, and possibly also a specific sex class, grade category, and weight category. Sex classes would include steers and heifers. Grade categories for the carcass grade and weight basis would reflect quality and yield grade categories and carcass weight ranges. Thus, for cattle consigned on a trading basis which includes the liveweight basis, bids in dollars per hundredweight of live animal, may be received for the following lot components: 1) liveweight, steer price; and 2) liveweight, heifer price. For cattle consigned on a trading basis which includes the "in the meat" basis, bids in dollars per hundredweight of carcass may be received for the following lot components: 1) "in the meat," steer base price; and 2) "in the meat," heifer base price. For lots consigned on a trading basis which includes the carcass grade and weight basis, bids will be received in dollars per hundredweight of carcass for the following lot components:

**Steers:**
- Choice Yield Grade No. 1-3 carcasses weighing less than or equal to 660 pounds;
- Choice Yield Grade No. 1-3 carcasses weighing more than 660 pounds;
- Choice Yield Grade No. 4-5 carcasses weighing less than or equal to 660 pounds;
- Choice Yield Grade No. 4-5 carcasses weighing more than 660 pounds;
- Good Yield Grade No. 1-3 carcasses weighing less than or equal to 660 pounds;
- Good Yield Grade No. 1-3 carcasses weighing more than 660 pounds;

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17 The yield grade and carcass weight categories were derived after consultation with Dallas McGinnis, Iowa State University Extension Marketing Editor. These breakdowns were selected because they represent categories for which cattle prices are presently reported. However, the reader should note that these categories could be modified to meet cattle industry needs.
- Good Yield Grade No. 4-5 carcasses weighing less than or equal to 660 pounds;
- Good Yield Grade No. 4-5 carcasses weighing more than 660 pounds;

Heifers:
- Choice Yield Grade No. 1-3 carcasses weighing less than or equal to 550 pounds;
- Choice Yield Grade No. 1-3 carcasses weighing more than 500 pounds;
- Choice Yield Grade No. 4-5 carcasses weighing less than or equal to 500 pounds;
- Choice Yield Grade No. 4-5 carcasses weighing more than 500 pounds;
- Good Yield Grade No. 1-3 carcasses weighing less than or equal to 500 pounds;
- Good Yield Grade No. 1-3 carcasses weighing more than 500 pounds;
- Good Yield Grade No. 4-5 carcasses weighing less than or equal to 500 pounds;
- Good Yield Grade No. 4-5 carcasses weighing more than 500 pounds.

Lot components for each trading method must be exclusive and exhaustive. That is, each animal in the lot must fall into one and only one of the lot components.

When cattle are consigned on a singular trading basis, bids are received only for the lot components applicable to the trading basis. Thus, for a lot of steers consigned under the liveweight basis, bids for only one lot component, "liveweight, steers" will be received. If, instead, a steer lot is consigned on the carcass grade and weight basis, bids will be received on all the aforementioned CGW steer lot components. In such cases where bids are being received on two or more lot components for one lot of cattle, the listing of the current bid on each lot component constitutes the lot's "bid array." When cattle are consigned on a combination trading basis, bids will be received on the applicable lot components for each
singular trading basis making up the combination trading basis. Thus, if a
lot of steers is consigned on the LC basis, the lot's bid array will be
comprised of bids received on the "liveweight, steer" lot component and all
of the CGW steer lot components.

Due to the adoption of rules allowing the receipt of bids on two or
more lot components per lot, there will be an array of bids on each lot at
any one moment during the auction. To become the high bidder on a lot
during the auction, a bidder need only raise the bid on any one of the lot
components in a lot's bid array. When there are no bidder offers to raise
any of the bids on any of the lots being auctioned concurrently, each lot
is sold simultaneously to the high bidder on the lot. The exchange (sale)
prices for each lot are given by the last bid on each lot component in the
lot's bid array. The purchasing packer will pay the exchange price given
by the final bid on each lot component for all cattle or carcasses in the
lot which meet the sex, grade, and weight specifications of the particular
lot component.

d. Lot withdrawal To protect consignors from unacceptably low
packer bids, auction rules should be modified to allow consignors to with-
draw part or all of the units composing their consigned lots. The withdraw-
al should be allowed after the lot component prices have been determined, but
prior to the time sales are consumated. Section 554.2328(3) of the Iowa
Code, the relevant auction statute, provides that the auctioneer in an auc-
tion with reserve¹⁸ may withdraw the goods comprising a lot at any time

¹⁸An auction "is with reserve unless the goods are in explicit terms
put up without reserve." Section 554.2328(3), Iowa Code (1977).
until he announces completion of the sale. In a simultaneous progressive
slaughter cattle auction this withdrawal could be accomplished in several
ways, depending in part on the trading basis under which the lot was con-
signed.

For lots on which bids are received on only one lot component, such as
the singular liveweight or singular "in the meat" basis, consignors could
be allowed to submit "reserve bids" along with their consignment instructions.
These reserve bids would serve as minimum acceptable price bids for the ap-
licable lot components. After the cessation of bidding, but prior to the
announced completion of the sale each reserve bid would be compared with
the last bid on the lot's lot component to determine whether the lot should
be withdrawn or sold to the last bidder on the lot. If the last bid price
when bidding ceased was lower than the specified reserve bid for the com-
parable lot component, market agency officials (i.e. the "auctioneer") would
automatically withdraw the entire lot. On the other hand, if the bid price
for the lot's lot component equals or exceeds the reserve bid, the sale of
the lot would be consummated.

Reserve bids are a desirable mode of unit withdrawal because the with-
drawal decision can be made by auction officials without contacting the con-
signor. However, it appears that reserve bids are a feasible withdrawal
mode only for lots having bid arrays comprised of a single lot component.
Use of reserve bids to withdraw lots on which bids will be received for two
or more lot components would also serve the function of providing minimum price protection. However, for these lots the reserve bid withdrawal mode would be unable to assure that realistic price differentials between the various lot components are registered. Thus, I propose that withdrawal of cattle in lots on which two or more prices are being determined, such as lots consigned on one of the four combination trading bases, the singular carcass grade and weight basis, or mixed lots consigned on either the singular liveweight or "in the meat" basis, be accomplished through use of a "withdrawal call." The withdrawal call would be a telephone call placed by auction officials to the consignor after the cessation of bidding and prior

19 Conceivably some packers may be opposed to the proposed reserve bid method of lot withdrawal. This opposition may arise from the lack of certainty last-bidder status would give a packer-buyer. The uncertainty remains, despite being the last bidder on a lot, because any impending lot purchase would always be subject to withdrawal.

In view of this possible opposition, several alternative modes of lot withdrawal have been considered. Unfortunately, both of these alternatives are characterized with inherent weaknesses.

The first alternative withdrawal procedure considered would enable consignors to bid, or hire brokers to bid in their behalf, on their own lots. Accordingly, if bid prices for a lot do not exceed the consignor's minimum acceptable price, he would buy his own lot back. Under section 554.2328(4) of the Iowa Code, sellers at auctions may be permitted to bid on their own lots. However, section 554.2328(4) of the Iowa Code requires that notice be given to all bidders that the seller reserves the liberty to bid on his own lot. Arguably, the possibility that packer-buyers may be bidding against producer-consignors will likely be more objectionable to packers than the proposed reserve bid withdrawal procedure.

The second alternative withdrawal procedure considered would permit the auction clerks or auction computer (in the case of the ESPSCA) to bid until the bids for each of a lot's components exceed the corresponding reserve bid. However, this method of lot withdrawal would likely be as objectionable to packers as the first alternative, because in essence this alternative also permits the consignor to bid against packer-buyers.
to the completion of the auction. After the auction official reports the final bid prices on each lot component for the consignor's lot(s), the consignor would be permitted to indicate how many and which of the units (cattle) in his lot(s) he desires to withdraw.

Not only does the rule permitting consignors to determine how many and which units in the lot will be sold allow consignors to withdraw lots due to unacceptably low bids on one or more lot components, but it also insures that the price differentials between lot components in a lot's final bid array reflect differences in values placed on the lot components by bidders. Because consignors are permitted to withdraw partial or entire lots, bidders have an incentive to enter bids in such a way that the bid on each lot component reflects the value of the lot component. By contrast, if consignors were not permitted to withdraw units from a lot after the cessation of bidding, the array of final bids on a lot may bear no relation to the values placed on the various lot components by bidders. Instead, bidders might enter bids so as to minimize the cost of becoming the high bidder. Accordingly, there is no reason to expect that bids on the various lot components will reflect differences in values placed on the components by bidders. This is because a bidder may raise a bid on a lot component that is relatively overpriced rather than raise a bid on a lot component that is relatively underpriced if by doing so he can become the high bidder on the lot at a lower cost. This situation, where a bidder can become the high bidder by offering less additional money for the entire lot than the previous high bidder offered, is likely to occur if one or more lot components represent a very small proportion of the total quantity in the lot.
e. **At-feedlot bids** Bids and reserve bids for cattle sold on a liveweight basis would be "at-feedlot" or "at-assembly yard" bids. That is, these bids would indicate the amount being offered for cattle weighed at or near the feedlot or assembly yard after observance of standardized handling procedures (sorting, feed and water restriction before loading, and loading time). Bids and reserve bids for cattle sold on the "in the meat" or carcass grade and weight basis would also be "at-feedlot" or "at-assembly yard" bids. That is, transportation would be paid by the buyer, but pay weights would be determined at the slaughter plant after slaughter and observance of standardized trimming and other procedures. In determining the pay weight, no correction for shrink would be made. This arrangement is feasible because a recent study indicates that distance shipped does not affect carcass weight. Prices determined in the slaughter-cattle exchange are at-feedlot or at-assembly point rather than delivered prices because the determination of delivered prices would require that all bids be adjusted for transportation costs before acceptance. If the bids were on a delivered basis rather than an at-feedlot basis, a new, higher bid may actually be a lower bid to the consignor after the additional delivery costs are subtracted. Thus, if delivered prices were to be determined, all bids would have to be adjusted for transportation costs. In order to avoid this cumbersome transportation cost adjustment procedure, I have proposed the use of "at-feedlot" and "at-assembly yard" prices.

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20 Raikes and Tilley [21b, pp. 83-89].
2. **Conduct of the Nonelectronic Simultaneous Progressive Slaughter Cattle Auction**

The role of the above described auction rule modifications are now demonstrated in the following description of the preparatory, bidding, and closing stages of the NESPSCA.

a. **Preparatory stage of the Nonelectronic Simultaneous Progressive Slaughter Cattle Auction** The preparatory stage of the auction encompasses the receipt of producer consignments, compilation of the auction sale bill, and arrangement of the bidding board for the receipt of bids.

1) **Receipt of the producer's consignment** Preparation for each simultaneous progressive auction session begins with the consignment of cattle. In making his consignment each producer-consignor has the prerogative to choose among a number of sales options. The flexibility inherent in his selection permits each producer to tailor a mode of sale most suited to his needs. Illustrative of the consignment decisions the producer is allowed to make is the following list of consignment instructions to accompany his consignments.

   a) **Number of lots to be consigned** Rather than require that a specified number of head comprise each lot, the auction market agency permits the consignor to determine the number of animals which are to be included in each lot. This prerogative lets the consignor strategically group his animals for sale in a manner which he thinks will yield the highest overall price. Accordingly, the consignor must determine and specify the number of lots to be consigned.

   The consignor's grouping decision may be economically constrained by the market agency's billing arrangement. Because the cost of auctioning a
lot is the same regardless of the number of head in the lot, the auction fee is assessed on a per lot basis.

b) Sex composition of each lot  In conjunction with his determination of the number of lots to be consigned, the consignor is permitted to determine and specify the sex composition of each lot. Auction rules permit the consignment of "all-steer" lots, "all-heifer" lots, and "mixed" lots. "Mixed" lots are comprised of both steers and heifers.

c) Consignment trading basis  The consignor is permitted to determine and specify the trading basis on which his cattle will be auctioned. The consignor may select one of three singular trading bases: the liveweight basis (L), the "in the meat" basis (M), or the carcass grade and weight basis (C). Alternatively, the consignor may select one of four combination trading bases: the higher of liveweight or "in the meat" basis (LM), the higher of liveweight or carcass grade and weight basis (LC), the higher of "in the meat" or carcass grade and weight basis (MC), and the higher of liveweight, "in the meat", or carcass grade and weight basis (LMC).

d) Location of the consigned cattle at the time of the auction  The consignor may decide to have his cattle auctioned while they are still in his feedlot. Alternatively, the consignor may deliver his cattle to one of the exchange's regional assembly yards prior to the auction.

e) Whether the consignor desires to have his cattle graded prior to sale  Regardless of the trading basis elected, the consignor may elect to have an exchange grader grade the cattle prior to the auction at consignor expense. If the cattle are graded, the grader's report will be included in the lot's description appearing in the auction sale bill.

If the consignor elects to have his cattle graded and chooses to have his
cattle sold while still in the feedlot, the producer will be required to pay for the cost of having the exchange dispatch a grader to the producer's feedlot and grade the cattle. If instead the consigned cattle are delivered to an exchange assembly yard prior to the auction and the consignor elects the grading option, the grading and weighing may take place there.

f. Whether the consignor elects the Name Disclosure Option

Upon making the Name Disclosure Option election the name of the consignor is included in the lot's description appearing in the auction sale bill.\(^\text{21}\)

\(^{21}\)Schrader et al. [23, pp. 15-16] and Holder [12, p. 25] have argued that there is a legal constraint barring disclosure of the producer's name to the buyers before the sale is consummated. For authority, these economists rely on Federal Trade Commission Advisory Opinion Digest No. 205 [29].

I think that Schrader and Holder have interpreted the meaning and impact of Advisory Opinion No. 205 too broadly. In support of my position, I make the following arguments:

1. The guidelines set forth by Federal Trade Commission Advisory Opinion No. 205 are inapplicable to the electronically conducted simultaneous progressive slaughter cattle auction because the circumstances surrounding the auction differ substantially from the facts upon which Opinion No. 205 is based.

2. Schrader and Holder, and not the Federal Trade Commission, concluded that disclosure of the seller’s name would make the proposed computerized statistical information system objectionable. Under the facts given the Federal Trade Commission, the names of producers participating in the computerized statistical reporting service were not to be revealed to subscribers. The Federal Trade Commission approved the plan as submitted. The opinion does not single out name disclosure as the one critical factor which makes the computerized system objectionable. Instead, the Commission advised the applicant "that it has no objection to the proposed plan, provided it is not used for some illegal purpose."

3. Being an advisory opinion, rather than a judicial conclusion, Advisory Opinion No. 205 does not have the prohibitory force of law. Thus, Advisory Opinion No. 205 could not be used as authority to prohibit an electronic auction market agency from publishing the names of consignors prior to the consummation of sales.
g) **Desired Delivery Interval** For those lots which remain in the producer's feedlot at the time of sale, the producer is allowed to specify a Delivery Interval. The Delivery Interval designates a day or a period of several days during which delivery to the buyer's packing plant is desired. Specification of a Delivery Interval is not necessary for lots delivered to an assembly yard prior to sale because they are presumed ready for the purchasing packer to load and haul as soon as the sale is consummated and confirmed.

h) **Reserve bids** For all-steer or all-heifer lots consigned on either the singular liveweight or "in the meat" basis, the consignor may specify a reserve bid.

i) **Whether consignor elects the Producer Haul Option** Due to the use of at-feedlot and at-assembly yard bids, the presumption arises that all cattle will be hauled from the feedlot or assembly yard to the place of slaughter by the purchasing packer or a commercial carrier employed by the packer. However, if the producer-consignor does not want the packer to

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22 Among the Delivery Intervals which the producer-consignor may designate are the following:

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<tr>
<th>Delivery Interval No.</th>
<th>Corresponding Delivery Date</th>
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<td>6</td>
<td>Saturday</td>
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<tr>
<td>7</td>
<td>Sunday</td>
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<td>8</td>
<td>Monday or Tuesday</td>
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<td>9</td>
<td>Tuesday or Wednesday</td>
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<td>12</td>
<td>Friday or Saturday</td>
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<td>13</td>
<td>Saturday or Sunday</td>
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<tr>
<td>14</td>
<td>Sunday or Monday</td>
</tr>
</tbody>
</table>
haul the cattle, the consignor may indicate his election of the Producer Haul Option at the time of his consignment. If this option is elected, the producer will also designate a Transportation Cost Schedule which specifies a set of transportation cost coefficients (in dollars per hundredweight of live animal) which indicate the fee he will charge the purchasing packer to haul the cattle to the packer's plant.

If a Transportation Cost Schedule is specified, the cost coefficients for hauling cattle to the various packing plants will be included in the lot's description included in the auction sale bill. Accordingly, these cost coefficients may be taken into account by the bidders.

If the individual consignor has prefiled one or more Transportation Cost Schedules with the market agency, the desired schedule can be designated by number. Otherwise, the consignor can submit the transportation cost coefficients along with his other consignment instructions.

2) Compiling the auction sale bill

Upon receipt of consignments the auction market agency will compile the pertinent consignment details for each lot to form a lot description. Included in each lot description is the assigned Lot Identification Number, the name and telephone number of the consignor if he elected the Name Disclosure Option, the producer's address, the location of the consigned cattle at the time of sale, the number of head of each sex in the lot, the consignment trading basis, the specified Delivery Interval, the Transportation Cost Schedule, and for those cattle graded prior to sale, the exchange grader's report. The

23 It should be noted that the producer-consignor's specified Reserve Bid is not included in the lot description, and therefore does not appear on the sale bill.
market agency then assembles all lot descriptions to form a sale bill, which is subsequently made available to all participating packer-buyers. An abbreviated sample of such a sale bill is presented in Figure 4.1.

After copies of the sale bill have been distributed, each packer-buyer may study the lot descriptions, determine which lots he is most interested in procuring, and decide the maximum price he would be willing to bid for the individual lots.

3) Preparing the bidding board for receipt of bids Meanwhile, the auction market agency, which operates the auction, has the duty to prepare the auction bidding board for receipt and recordation of bids.

The bidding board is a chalkboard divided into a number of rows and columns by painted lines. See Figure 4.2. Each column on the bidding board represents a specific consigned cattle lot. At the top of each column is printed the lot's Lot Identification Number, which corresponds to the Lot Identification Number listed with each lot description on the sale bill. Running across the bidding board are rows, each representing a different lot component. At the left side of the board is written the name of the lot component represented by the row.

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24 To assist the packer-buyers in rapidly identifying lots which are suited to their procurement needs, lots on the sale bill could be listed according to trading basis (i.e. L, M, C, LM, LC, MC, LMC) and sex. Within each categorical listing, lot descriptions could be listed on the basis of Delivery Interval, with those lots designated for earliest delivery being listed first.

25 While the bidding board illustrated in Figure 4.2 has only four lot columns, a simultaneous progressive cattle auction agency could readily expand the size of the bidding board and thereby increase the number of lots which the board could accommodate.
LIVEWEIGHT BASIS CATTLE:

Steers:

-Lot No. 1001-L-S
Producer: Mr. Carl Cattlefeeder
Address: RR, Spencer, Iowa 50051
Tel. No.: 515-232-7643
No. of Head: 50 head
Location of Cattle: Producer's Feedlot - 1 1/2 mi. north of Spencer, Iowa on Highway #18
Delivery Interval: No. 9
Grade and Weight:

<table>
<thead>
<tr>
<th>No. Head</th>
<th>Grade</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Choice YG #1-3</td>
<td>1101-1200 lb.</td>
</tr>
<tr>
<td>8</td>
<td>Choice YG #1-3</td>
<td>1001-1100 lb.</td>
</tr>
<tr>
<td>15</td>
<td>Choice YG #4-5</td>
<td>1101-1200 lb.</td>
</tr>
<tr>
<td>10</td>
<td>Good YG #1-3</td>
<td>1001-1100 lb.</td>
</tr>
</tbody>
</table>

Transportation Cost Coefficients:

ABC Packing Co., Dubuque $0.85
DEF Packing Co., Spencer $0.15
GHI Packing Co., Mason City $0.65

JKL Packing Co., Sioux City $0.45
MNO Packing Co., Des Moines $0.75
PQR Packing Co., Dakota City, Nebraska $0.50

Heifers: None Consigned
Mixed: None Consigned

IN THE MEAT BASIS CATTLE: None Consigned

CARCASS GRADE AND WEIGHT BASIS CATTLE:

Steers:

-Lot No. 1002-LMC-S
Producer: X
Address: RR, Garner, Iowa 52443
Tel. No.: X
No. of Head: 100 head
Location of Cattle: Mason City Assembly Yard
Delivery Interval: No. 1
Estimated Average Weight: 1150 lbs.

Figure 4.1. Illustration of the sale bill which would be distributed to all packer-buyers participating in the Nonelectronic Simultaneous Progressive Slaughter Cattle Auction.
Figure 4.2. An illustration of the chalk bidding board which could be used for recordation and display of bids during a Nonelectronic Simultaneous Progressive Slaughter Cattle Auction session.
b. **Bidding stage of the Nonelectronic Simultaneous Progressive Slaught-
er Cattle Auction**  
Once the preparatory stage is completed, it is time to commence the bidding stage of the auction.

At a predesignated time, the packer-buyers will assemble at the auction headquarters and await the commencement of bidding. Once the starting signal is given, each packer-buyer has an equal opportunity to enter incremental bids on any or all lots consigned and on any lot component which makes up the lot's bid array.

Although the auction rules could permit the auction officials to designate some starting price for the base prices on each lot, I instead propose that the auction start with prices for each lot component at zero and thereby allow packer-buyers to set the first price. This means that the initial bid on a lot is likely to be $35.00, 40.00, 45.00, or more per hundredweight. Once the first price bid for each lot component is entered, successive bids are likely to range between $0.05 and $1.00 per hundredweight. Minimal bid increments permitted are $0.05 per hundredweight.

Although bidding could proceed in a number of ways, it might be most simply accomplished by permitting each bidder to give his bid to an auction clerk. The clerk will erase the old bid and use chalk to write the new, incrementally-higher bid in the appropriate place on the chalkboard. Then, the clerk will record the bidder's identification code number at the bottom of the lot bid array, to indicate that he was the last bidder on any lot component for the particular lot. This bidding procedure can perhaps be best illustrated by the exemplary bidding sequence which follows below.

Suppose that Packer-Buyer ABC is the first person to enter a bid during a particular session of the Nonelectronic Simultaneous Progressive Slaughter
Cattle Auction. Acting pursuant to his desire to purchase cattle consigned on the liveweight basis only, ABC instructs an auction clerk to enter a steer price bid of $44.00 per hundredweight on Lot No. 1001-L-S. Taking ABC's bid the clerk records the bid by following a simple procedure which is performed after each bid is received. To begin the bid recording procedure the clerk notes that there has been no prior bid entered in the box corresponding to liveweight basis steer price in bidding board Column No. 1, where bids for the steer price on Lot No. 1001-L-S are recorded. (If there had been a prior bid entered for this lot component, the clerk would have erased it or crossed it out.) Then, the clerk uses chalk to print the numerals pertaining to the new bid. In this case, the clerk would print "44.00." See Figure 4.3. Next, the clerk would focus his attention on the "Last Bidder Identification Box" at the bottom of the Lot No. 1001-L-S bid array; erase or cross out the identification letters of the previous last bidder on the lot; and print ABC's identification letters - "ABC" in the Last Bidder Identification Box of Column No. 1. See Figure 4.3.

Furthermore, suppose that Packer-Buyer DEF has observed the entrance of ABC's bid and decides to raise the present $44.00 per hundredweight bid on Lot No. 1001-L-S by $0.75 per hundredweight. Thus, he instructs an auction clerk to enter a bid of $44.75 per hundredweight. Accordingly, the clerk focuses on Column No. 1 (See Figure 4.4) where bids for Lot No. 1001-L-S are recorded. The clerk observes that a prior steer bid of $44.00 per hundredweight has been entered, erases or crosses out the "44.00" bid and prints the new bid of "44.75." Then, the clerk erases or crosses out the previous bidder's (ABC's) identification code in the Column No. 1 Last Bidder Identification Box, and prints DEF's Identification Code "DEF". DEF
<table>
<thead>
<tr>
<th>COLUMN NO.</th>
<th>LOT IDENTIFICATION NO.</th>
<th>1001-L-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIVE-WEIGHT:</td>
<td>Steer Price</td>
<td>44.00&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Heifer Price</td>
<td>X</td>
</tr>
<tr>
<td>IN THE MEAT:</td>
<td>Steer Base</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Heifer Base</td>
<td>X</td>
</tr>
<tr>
<td>CGW: Choice 1-3, ≤660</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Choice 1-3, &gt;660</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Choice 4-5, ≤660</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Choice 4-5, &gt;660</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Good 1-3, ≤660</td>
<td>X</td>
<td></td>
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<tr>
<td>Good 1-3, &gt;660</td>
<td>X</td>
<td></td>
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<tr>
<td>Good 4-5, ≤660</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Good 4-5, &gt;660</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>CGW: Choice 1-3, ≤500</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Choice 1-3, &gt;500</td>
<td>X</td>
<td></td>
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<tr>
<td>Choice 4-5, ≤500</td>
<td>X</td>
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<td>Choice 4-5, &gt;500</td>
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<td>Good 1-3, ≤500</td>
<td>X</td>
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<tr>
<td>Good 1-3, &gt;500</td>
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<tr>
<td>Good 4-5, ≤500</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Good 4-5, &gt;500</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LAST BIDDER IDENTIFICATION NO.</th>
<th>ABC&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
</table>

<sup>a</sup>ABC's bid of $44.00 per hundredweight, the first bid entered on Lot No. 1001-L-S, is entered in the Liveweight Basis Steer Price Box.

<sup>b</sup>ABC's Bidder Identification Code, "ABC", is written in the Last Bidder Identification Box for Lot No. 1001-L-S.

Figure 4.3. Entry of ABC's initial bid and ABC's Last Bidder Identification Code on liveweight basis Lot No. 1001-L-S.
aDEF's incremental liveweight steer base price of $44.75 per hundredweight is entered in Lot No. 1001-L-S's Liveweight Steer Base Price Box, indicating that this is the last bid on this lot's liveweight steer price.

bDEF's Identification Code - "DEF", is written in Lot No. 1001-L-S's Last Bidder Identification Box, indicating that DEF now maintains the status of "Last Bidder" on Lot No. 1001-L-S.

Figure 4.4. Entry of DEF's incremental bid and Last Bidder Identification Code on liveweight basis Lot No. 1001-L-S.
is now momentarily considered the last bidder on Lot No. 1001-L-S. If no more bids were entered on the lot during the remainder of the auction session, and assuming that the $44.75 per hundredweight bid would equal or exceed the consignor's reserve bid, DEF would purchase Lot No. 1001-L-S on a liveweight exchange basis at a price of $44.75 per hundredweight.

c. Closing stage of the Nonelectronic Simultaneous Progressive Slaughter Cattle Auction The auction session's bidding stage closes when no packer-buyer is willing to enter another bid on any lot component in any consigned cattle lot.

Before announcing the completion of the sale, the auction agency clerks must follow a procedure to determine whether withdrawal of any lot is required and the exchange basis for lots consigned on a combination trading basis.

For those all-steer or all-heifer lots consigned on either the liveweight or "in the meat" basis, this procedure requires that the auction agency clerks compare the bid price for the relevant lot component on the individual lot with the consignor's reserve bid. If the lot component bid does not equal or exceed the corresponding reserve bid, the lot is withdrawn from the auction. If, instead, the bid price on the lot component when bidding ceased equals or exceeds the corresponding reserve bid, the lot will be sold to the last bidder on the lot pursuant to the terms of the trading basis.

For mixed sex lots consigned on the liveweight or "in the meat" basis and lots consigned on a combination trading basis, auction agency clerks must place a withdrawal call to the consignor and inform him of the bid prices in his consigned lot's bid array. Once informed of his bid array,
the consignor must make two decisions. First, for lots consigned on a combination trading basis the consignor must examine the bids pertaining to the lot components of the various trading bases and select one exchange basis. Once the consignor makes this selection, the selected trading basis becomes the lot's exchange basis and any animals delivered to the last bidder are delivered pursuant to the terms of the selected exchange basis. Second, the consignor must determine whether all, part, or none of the cattle making up the consigned lot are to be withdrawn.

After consignors have had an opportunity to withdraw their lots or specify the exchange basis for their lots, an auction official will formally declare that all remaining lots have been sold "simultaneously" to the last bidder on each lot, regardless of the lot component on which the last bid was entered. The sale prices for each lot are represented by the final lot bid array for the elected exchange basis when bidding ceased.

For those lots which are sold, the auction agency will confirm the sale with the consignor. In addition, the consignor will be informed of the identity and location of the purchasing packer, as well as the final lot bid array.

For those lots which were delivered to an exchange assembly yard prior to the auction, the purchasing packer is obligated to transport the purchased cattle to his slaughtering plant. For those cattle lots which remained in the feedlot at the time of sale, the purchasing packer upon confirmation is required to contact the consignor and make a delivery appointment pursuant to his designated Delivery Interval.

If the consignor has elected the Producer Haul Option, the producer will be expected to haul his cattle or hire a commercial carrier to haul
his cattle to the place of slaughter. Because the packer's purchase price was determined on an at-feedlot basis, he will be expected to pay the consignor the transportation fee (in dollars per hundredweight of live animal) specified on the consignor’s Transportation Cost Schedule for the particular packer.

If the Producer Haul Option was not elected, the purchasing packer is expected to bear the cost and responsibility of transporting the cattle. Conceivably, the exchange facilities could be used after each slaughter cattle auction to conduct a transportation service auction. This auction would enable packers to purchase transportation services from commercial carriers who offer to haul the cattle comprising a specified lot from the feedlot or assembly yard to the place of slaughter. The auction could be a simultaneous regressive (declining price) auction with the winning bidders (i.e. carriers) and prices determined by the lowest bid on each lot.

If the consignor's lot(s) is(are) withdrawn, the auction agency will inform the consignor of this action and each lot's final bid array. Furthermore, the agency will request instructions as to whether or not the producer wishes to reconsign the lot(s) for sale during a later auction session.

D. Electronification of the Simultaneous Progressive Slaughter Cattle Auction

As the fourth and final step in my development of the Electronic Simultaneous Progressive Slaughter Cattle Auction, I now present a discussion which focuses on the selection, programming, and operation of the electronic equipment used to electronically conduct the simultaneous progressive slaughter cattle auction described in the previous section (Section C).

This portion of the development begins with a discussion of the need
for electronification of the simultaneous progressive cattle auction (Subsection 1). In view of the apparent desirability of conducting the auction electronically, I then commence a search for an electronic marketing system which will accommodate a simultaneous progressive slaughter cattle auction. The first step in this search involves an identification of the characteristics the overall electronic marketing system should possess (Subsection 2). As the second step in this search, five categories of auction functions which can be performed electronically are identified (Subsection 3). The final step in this search attempts to identify electronic hardware components which can perform the functions comprising each auction function category (Subsection 4). Based on these findings, certain electronic components are then selected and combined to yield the proposed ESPSCA system (Subsection 5).

Once the electronic auction system has been outlined, my discussion focuses on operation of the electronic system. The first operational subject involves the description of a number of basic programmed-function subroutines which should be programmed for use during the bidding stage of the auction (Subsection 6). Once this preliminary material has been covered, I then present an overview of how the electronic auction would work, dividing the discussion into the preparatory, bidding, and closing stages of the auction (Subsection 7). This section closes with an enumeration of a number of extensions to the basic ESPSCA proposal which conceivably could be programmed or developed (Subsection 8).
1. Need for electronification of the simultaneous progressive cattle auction

While the Nonelectronic Simultaneous Progressive Cattle Slaughter Auction appears to be a promising price determination mechanism, I believe serious consideration should be given to the development of a system for conducting the auction electronically. Conceivably the chalk bidding board could be utilized as an interim or temporary bidding device while the simultaneous auction concept is being introduced and initial volume is low. However, this bid recordation device is characterized by several weaknesses which make it poorly suited for permanent use. For example, the slow and awkward bidding process inherent in the chalk bidding board inhibits the high-volume trading which would be incurred by a centralized exchange used in marketing a large portion of the cattle fed in Iowa. In addition, the chalk bidding board requires that participating packer-buyers assemble at a central location for the purpose of bidding. Not only is the assembly of packer-buyers physically inefficient, but it also inhibits the preservation of bidder anonymity. Under the chalkboard bidding method, an observant packer-buyer in attendance would be able to observe a fellow packer-buyer enter a bid and then watch as the auction clerk enters the bid and packer identification number on the chalkboard. In this manner, participating packer-buyers would rapidly learn each packer’s identification code. Once this scheme of secret packer identification codes is broken down, the identity of the packer-buyer who stands to purchase a lot will be clearly revealed to competing bidders because his identification code will be overtly displaced in the Last Bidder Identification Code Box at the bottom of each column of the chalk bidding board.
In view of these weaknesses and the apparent need to conduct the simultaneous progressive auction electronically, I began to search for an electronic marketing system (EMS) which would accommodate the auction. This search is described in the following three subsections.

2. **Characteristics the overall electronic marketing system should possess**

The first step of my search involved the identification of characteristics or qualities which the selected electronic marketing system should possess. These characteristics are enumerated below.

a. **Accommodation of the simultaneous progressive auction transaction system**

The primary selection criterion is that the electronic system accommodate contemporaneous bidding on more than one lot. From an operational standpoint this means that the EMS must be able to simultaneously receive, record, and keep track of bids from numerous bidders, each bidding on different lots of cattle.

b. **Multiple-price determination**

To make the use of market-determined quality price differential schedules possible, the selected EMS must permit the determination of more than one price per lot. In part this means that the EMS must make it possible for each bidder to view the whole bid array for each lot being auctioned.

c. **Availability of EMS components**

Parties interested in establishing an ESPSCA will want to select an EMS having components which are readily available for operational use. If there are presently no available electronic components which could be brought together and programmed for the ESPSCA, implementation of the ESPSCA may have to be delayed for years until electronic engineers can design the needed components.
d. Cost of procuring and operating the EMS. The cost of the EMS will likely influence the producer and packer interest in developing the system. Thus, while selection of the cost minimizing EMS may neither be required nor desirable, the system's cost of procurement, installation, and daily operation, should be closely evaluated.

e. Simplicity of operation. In an attempt to reduce the number of employees needed and the degree of technical training each employee must receive, the simplicity of operating the EMS should be another factor considered during the system selection process. Simplicity of operation should be viewed not only from the standpoint of the ESPSCA Headquarters, but also from the position of the individual packers who must hire or train personnel to operate the bidding component.

f. Trading capacity. The trading capacity of the EMS must be sufficient to at least handle a major portion of the cattle marketings in Iowa. In addition, the EMS should allow for possible expansion to include cattle marketings from surrounding states. Furthermore, to permit interlot price comparisons, the EMS should be able to auction several hundred lots simultaneously. To achieve the needed trading capacity, it may be necessary for the EMS to utilize an electronic computer.

g. Error minimization. In addition, the selected EMS should be designed to minimize the number of errors made by participating consignors and bidders.

h. Adaptability to change. Ideally, the selected EMS should be adaptive to new trading innovations or trading options which may be subsequently developed. Adaptability to change provides some assurance that the EMS will not be readily outdated or abandoned for newer electronic devices.
before the EMS has paid for itself.

3. Identification of major auction functions

The second step in my search for an EMS involved the identification of the five categories of simultaneous progressive auction functions which I believe can be performed electronically. These function categories are as follows:

1. Auction Control - coordination and monitoring of all other electronic systems;
2. Consignment - transmission of consignment instructions;
3. Sale Bill Communication - transformation of electronic transmissions into a printed listing of consigned lot descriptions;
4. Remote Data Transmission - electronic transmission of consignments and bidding data between geographically remote locations; and
5. Bidding - receipt and recordation of bids entered to determine a lot's sale price.

4. Search for electronic marketing system components

The third step in this search involved an attempt to identify electronic components which can perform the functions in each of the five function categories.

a. Auction control function The conduct of the ESPSCA must be controlled by an electronic component which I shall call the "central processing unit" (CPU). Most likely, the electronic component which will perform this function will be a high-speed electronic digital computer. However, before reaching this conclusion, it is necessary to further analyze the specific functions the CPU must perform and the characteristics the CPU should possess.
1) **Functions to be peformed by the CPU**

To effectively control and monitor the ESPSCA, the unit acting as the CPU should be able to perform the following functions.

a) **Receive consignment calls**

The central processing unit will have to receive the consignment instructions as transmitted by the producers' consignment terminals.

b) **Compile and transmit the sale bill**

Once the consignments have been received, the CPU must compile the relevant consignment terms for each lot to form a lot description, and subsequently organize the lot descriptions into a sale bill. The CPU must then transmit the sale bill to all bidding stations.

c) **Commence the auction**

Prior to each auction session the CPU will have to prepare the bidding machines for the receipt of bids. Then, at a predetermined time, the CPU must signal to the bidders that the auction has commenced. This signal might be given by illumination of a green light on each bidding terminal's display area, or the bidding terminal's control panel.

d) **Record bids**

The CPU must register each bid when entered through the bidder's remote bidding terminal, distinguish between two or more different bids made by two or more separate bidders at almost the same instant, determine which lot and lot component the bid is for, determine the identify of the bidder, register the bid increments in the computer's memory, and raise the bid appearing on the bid display as seen by all those bidders viewing the particular lot's bid array.
e) **Warn that the auction session is nearing completion**

The CPU, which acts as the auctioneer, must warn bidders that the auction session is nearing completion and that final bids should be entered. This warning might be given through use of a series of flashing amber lights which are illuminated on the control panel of each bidding terminal.

f) **Close the auction session**

When the allotted time period for the auction session has elapsed or the number of bids entered per minute drops to a predetermined rate, the CPU should stop accepting bids and signify to the bidders that the auction session has ended. This task may be performed by electronically locking-up the bidding terminals, or by disengaging the CPU from the bidding terminals such that new bids can not be registered.

g) **Determine whether each consignor desires to withdraw his consigned lot(s)**

Once an auction session's bidding has ceased, the CPU will need to place a withdrawal call to all consignors who have not submitted reserve bids in their consignment instructions. During this conversation the CPU will need to report the bids comprising the bid array on each of the consignor's lots and request that the consignor designate the number of cattle in each lot he desires to withdraw. Furthermore, for lots consigned on a combination trading basis, the consignor will be expected to designate the elected exchange basis. For those lots on which reserve bids were submitted, no withdrawal call will be necessary. Instead, the CPU must use the reserve bids to determine whether the consignor's lot must be withdrawn. If the bid price on the lot is lower than the lot's reserve bid, the CPU must withdraw the lot. Otherwise, the CPU must consummate the sale of the lot. The CPU must then place a confirmation call to the consignor.
During the confirmation call the CPU must report whether or not the lot was sold, and if so, the exchange price and the name of the purchasing packer.

h) **Inform each bidder of his purchases** After the completion of each auction session the CPU should compile and transmit an individualized purchase list to each buying station. The purchase lists should include the following information for each lot a bidder has purchased:

1. The Lot Identification Number;
2. The final bid array;
3. The producer's name;
4. The producer's telephone number and address;
5. The exchange basis on which the cattle were purchased;
6. The total number of steers and heifers in the lot which will be delivered;
7. The producer's desired Delivery Interval; and
8. The producer's Transportation Cost Schedule if the Producer Haul Option has been elected.

In addition, the confidential purchase list might include a computer tabulated report which gives relevant statistical information on the particular packer's daily purchases.

To preserve the confidentiality of the list, the CPU should transmit it directly to the remote data receiver at the particular buyer's bidding station.

i) **Give each bidder his bidding status whenever requested during an auction session** To assist the individual bidder in executing his bidding strategy during each auction session, the CPU should be able to rapidly indicate the lots on which he has placed the last bid.

j) **Give market news to producers, buyers, and the media** Upon request, the CPU should compile and transmit market news reports to interested producers over WATS telephone lines, to packers and brokers over
the remote data transmission network, and to radio stations and other media over telephones and teletypes. The content of these market summaries may vary in accordance with the user's needs. Because the information comprising these reports can be derived from data compiled by the CPU, the market reports may be constantly updated.

2) Characteristics which the centralized processing unit should possess

Discussed below are four characteristics which the CPU should possess in order to facilitate the performance of the auction control functions outlined above.

   a) Monitors remote bidding stations

   To accommodate the ESPSCA and eliminate the cost of each packer maintaining a group of buyers at a centralized auction location, the CPU must be capable of centralized location while monitoring all the bidding terminals in packer and broker bidding stations situated at the individual packer's or broker's office.

   b) Capacity to be quick and responsive to user demands

   In order to accommodate the expected high volume of cattle trading the CPU must have sufficient capacity to conduct the auction at the rapid pace established by the bidders.

   c) Voice communication

   To facilitate receipt of consignment calls via touch-tone telephone and to make withdrawal calls and confirmation calls to the producer-consignors once bidding has ceased, the CPU must be equipped with voice communication facilities. In addition, the audio communication facilities reduce the impersonality associated with a computerized exchange.

   d) System security

   To minimize or eliminate the incurrence of computerized theft, manipulation, or embezzlement, the CPU should
be as tamperproof as possible. This characteristic requires not only the reduction of human involvement in the computerized operations, but also the selection of an electronic system that prevents such computerized thefts from remote locations and portable computer terminals.

3) **Electronic components available to perform the auction control functions** There are several variables entering the computer procurement decision which make discussion of the selection process difficult. For example, computer size selection may depend on what is readily available for the market agency to use because the market agency host may already rent or own an electronic computer. Thus, in this chapter I will not attempt to describe various types of digital computers, nor various sizes and models which are available. Instead, I leave this to the people establishing the ESPSCA market agency and the computer company sales representatives. Together, these parties should be able to select the size of computer best suited for the needs of the ESPSCA.

Perhaps the best way to enable producers with touch-tone telephone consignment terminals to receive communications from the electronic marketing system is to equip the CPU with an audio-response unit. An audio-response unit converts digital commands from the CPU into simulated human speech. [5, p. 151] Thus, the CPU would be able to make audible responses to producers through their touch-tone telephone consignment terminals.

One of the large electronic computer manufacturers, International Business Machines, Inc. (IBM), offers the IBM 7770 Audio Response Unit Model 3 which can be incorporated with the firm's computer systems. This IBM audio-response unit provides for a composed audio response to digital inquires from an IBM 1001 Data Transmission Terminal, a touch-tone telephone, or
other inquiry-type terminals. The spoken response is composed of American English vocabulary, prerecorded in a male or female voice on a magnetic drum within the 7770 unit. All audio responses are transmitted over the appropriate common-carrier communication facilities which lead the message back to the inquiry terminal.

From a technical standpoint IBM describes the process of conducting a communication between the audio response unit and a producer-consignor using a touch-tone telephone consignment terminal as follows:

To make the inquiry of the 7770, the calling party enters a series of characters from his terminal. The 7770 passes the characters one by one via the byte multiplexer channel to the System/370, which processes the inquiry and sends a response message back, character by character to the 7770. This response message is a series of drum word addresses that the 7770 uses to select proper words for this spoken reply. Using this audio-response unit, there is no limit on the length of the inquiry or the response, however, there is a maximum of 128 words in the standard 7770's vocabulary.

Thus, through use of the audio-response unit, producers could readily communicate with the computer through the medium of their touch-tone telephone, rather than having to use a punched card or teletype input terminal.

b. Consignment function The ESPSCA consignment functions which encompass the entrance of consignment orders, as well as the receipt of market data and sale confirmations, should be accommodated through use of a remote consignment terminal (RCT).

During the initial stage of the new simultaneous progressive slaughter cattle auction when trading volume is low, the most economical method of entering consignment orders may be to have each individual producer utilize
his personal telephone to reach an inward WATS line to the auction headquarters. After connection with the auction headquarters, the producer could place the consignment order by talking to an auction clerk.

The clerk would then have to code the producer's consignment instructions and have it punched on computer cards, before feeding the consignment terms into the computer. Not only would this intermediate process be expensive, but there would be a longer time delay between the time the consignment was made until the consignment instructions were entered into the computer and scheduled for auction. A further disadvantage in this arrangement is that the interim coding and keypunching steps would create an opportunity for errors to creep into the producer's consignment instructions.

In view of these disadvantages in the indirect consignment arrangement, it is expected that when the volume of trading rises, the use of an electronic device which enables the consignor to transmit consignment data directly with the CPU at auction headquarters will be more economical and more efficient. In anticipation of the need for selecting a remote consignment terminal, it is necessary to consider the functions to be performed by the RCT, the desirable characteristics which the RCT should possess, and the types of electronic hardware components presently available to perform the consignment functions.

1) **Functions to be performed by the remote consignment terminal**

The RCT must facilitate four types of conversations with the CPU and/or its audio-response unit. These four types of conversations are: a) the consignment call, b) the confirmation call, c) the pricing report, and d) the correction-modification call.
a) **Consignment calls**  
When a producer's cattle approach market weight he will want to contact the CPU and enter consignment instructions. Later using the RCT to become connected with the CPU, the producer will have to identify himself to the CPU by giving his producer number. In turn, the CPU will have to acknowledge the producer's membership or registration with the ESPSCA market agency. Before entering his consignment, the producer may desire a price summary of recent trading on the exchange and a volume report regarding cattle already consigned for a certain auction session. If after receiving this market information the producer decides to consign one or more lots of cattle, he will have to use the RCT to enter the pertinent data describing the lots to be consigned and consignment prerogatives (terms of consignment) he has elected.

b) **Withdrawal and confirmation calls**  
After bidding during an auction session has ceased and before the completion of the auction, the CPU will need to place withdrawal and confirmation calls to consignors. The remote consignment terminals must receive these transmissions and transform them into audible language which the consignors can understand. Furthermore, if a consignor's lot has been withdrawn and he wishes to immediately reconsign his cattle, the remote consignment terminals must be able to accommodate the reconsignment.

c) **Market price report**  
At any time during the trading day producers may want to use the remote consignment terminal to contact the CPU and request various market price reports. The reported information may include the price trend for the various trading bases during the present auction session, the volume of bidding, the number of head consigned for a specified auction session, the summary of prices during the previous
auction session, and the U.S.D.A. livestock marketing estimates.

d) **Correction-modification calls** The remote consignment terminals should also accommodate correction-modification calls. These conversations would enable a consignor to modify the terms of his consignment or make corrections in the CPU's receipt of information during the consignment call.

2) **Desired characteristics of the remote consignment terminals**

The desirable characteristics of the remote consignment terminals, which will allow a consignor to participate in the four types of consignment conversations, are described below.

a) **Producer's cost of procuring the remote consignment terminal** The cost of buying or leasing the electronic hardware which serves as the remote consignment terminal should be low enough that most producers will be able to afford their own unit.

b) **Direct communication to the CPU** The remote consignment terminal desirably should be linked directly into the CPU's audio-response unit. Direct communication between the producer-consignor and CPU eliminates the need for an intermediate message translation or keypunching, and thereby reduces the possibility of errors in consignment instructions.

c) **Verbal confirmation of data transmission** The remote consignment terminal should allow verbal confirmation of coded data transmitted to the CPU by a consignor. The use of verbal confirmation will allow the producer to immediately detect whether or not the computer correctly received the message, or whether he has made a coding error.
3) **Available electronic hardware components which can perform the consignment functions**  

Because a number of electronic units presently being manufactured have the desirable characteristics described above and could be programmed to perform the consignment function, a cattlefeeder's selection of the device to serve as his RCT will be based primarily on the expected consignment volume and the cost of procuring or leasing the consignment unit. Several of the hardware units which might serve as a consignment terminal are now described.  

a) **Touch-tone telephone consignment terminal**  

The touch-tone telephone could provide moderate-sized cattlefeeders with relatively inexpensive access to the central processing unit. Through the use of a standardized code and the depression of the appropriate buttons on his touch-tone telephone, a cattlefeeder could make inquiries of the CPU and transmit pertinent consignment data on his lots. Upon receipt of these coded transmissions, the CPU could process the inquiry and by means of an audio-response unit provide the producer with a verbal response over the telephone lines which link the remote consignment terminals with the CPU's audio-response unit. [5, p. 151]

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26 The use of touch-tone telephones, card-dialing telephones, audio-response units, and WATS lines for communication between producers and the CPU, has previously been included by Schrader et al. [23, pp. 24, 28, 29-34] and Holder [12, pp. 14, 43-46] in their electronic exchange proposals.
b) Card-dialing telephone consignment terminal  

Somewhat larger volume cattle feeders and local farm supply companies may find a card-dialing telephone to be an ideal remote on-line\textsuperscript{27} consignment terminal. Consignments made via card-dialing telephones would be made in a manner similar to that for the touch-tone telephone except that card-dialing phone terminals accept consignment data such as the auction headquarter's telephone number, the consignor's identification number, and the consignor's Transportation Cost Schedule, recorded in the form of punched cards. In response to consignment data transmissions from card-dialing telephone terminals, the CPU would direct that audible responses be made by the audio-response unit.

c) Punched-card consignment terminal  

Low-volume punched-card transmission terminals are also available to serve as remote consignment terminals. These input/output devices allow data punched on an 80-column card to be transmitted over communication lines to the CPU. [5, p. 155] These punched-card units are designed such that standard information (e.g. the consignor's identification number and the consignor's Transportation Cost Schedule) may be transmitted by means of punched cards and variable information (e.g. the consignor's selection of a grading option and the consignor's decision regarding the name disclosure option) to be manually keyed by the operator. [5, p. 155]

By the use of a low-cost port-a-punch and specially designed 80-column cards, data cards could be punched at a remote location without the need

\textsuperscript{27}The term "on-line" indicates that the peripheral hardware unit is directly tied into the computer [4, p. 21] such that it operates under the direct control of the central processing unit. [2, pp. 265, 270]
for a sophisticated key punch. The special cards have partially perforated holes such that a slight pressure with a stylus will cause the cardboard hole to pop out. [4, p. 53] The port-a-punch is a simple frame holder which facilitates the punching process. [4, p. 53]

Punched-card consignment terminals are advantageous because the use of prepunched cards eliminates many of the errors likely to arise during on-line composition of consignment transmissions made by depression of buttons on a touch-tone telephone.

d) **Teletypewriter consignment terminal** Brokerage firms which offer ESPSCA consignment services to producers may wish to be equipped with a teletypewriter terminal.\(^{28}\) These keyboard/printer devices permit on-line composition of consignment data transmissions by use of their manual keyboard and the receipt of printed, rather than audible responses from the CPU. [5, p. 155] In addition, teletypewriter terminals can be equipped to transmit consignment data at the rate of 75 characters per second by the use of a prepunched paper tape. [4, p. 508; 5, p. 156] Utilization of the latter data input method is advantageous because it results in transmissions at speeds considerably higher than the input speed of on-line keyboard message composition, resulting in lesser tie-up of communication lines and the CPU. [5, p. 156] The comparative input-speed advantage of the paper tape is enhanced by the fact that infrequent or first-time ESPSCA consignors who are likely to utilize the consignment broker may not have prefiled their address, telephone number, and Transpor-

\(^{28}\) The use of teletype terminals was considered by Schrader [23, pp. 19, 24] in his electronic exchange proposal.
tation Cost Schedule with the auction headquarters. Failure to prefile pertinent consignment data will require a longer consignment data transmission.

   c. Sale bill communication functions  
   The sale bill communication functions require the selection of a device I shall call the "remote data receiver" (RDR). The remote data receivers must be able to receive lengthy transmissions of printed documents, such as the daily sale bills and statistical market reports, from the central auction headquarters. Because the speed of this transmission is not as essential as that with the bidding stations be able to respond to the messages transmitted from ESPSCA Headquarters, it appears that this function might be performed by either a teletypewriter or a line printer terminal. However, before selecting an electronic device to serve as the RDR, it is desirable to consider the functions to be performed by the RDR, the characteristics the RDR should possess, and the capabilities of the alternative electronic hardware devices which could perform the sale bill communication functions.

   1) Functions to be performed by the remote data receiver  
   The primary function to be performed by the RDR is the receipt and printing of transmitted information. The types of information which would be transmitted to the RDR for each auction session include the following.

      a) Auction sale bill  
      To facilitate bidding from remote bidding stations, each regular bidder must receive a catalogue-type listing prior to each auction session which presents the lot description for each of the lots consigned for sale during the day's auction session. The specific details to be included in each lot description would be the same as those included in the NESPSCA sale bill.
b) **Confidential purchase list**  Once the CPU has consummated the auction sales it will compile and transmit a confidential purchase list to each buying station. The RDR at each buying station should receive and print these purchase list transmissions so that each buyer will have a copy of the list for future reference. Specifically, a packer-buyer will use the information on the purchase list to establish contact with the producers in order to make delivery appointments, as well as to figure the amount to pay each producer. The exact information to be included on the purchase list has previously been listed under the auction control function.

c) **Market news summary**  For the convenience of bidders, the CPU might also transmit a comprehensive market summary to the RDR at each bidding station after the close of every auction session. The summary might be comprised of a statistical report regarding the cattle traded on the ESPSCA during the past week. The specific information included in the market news summary might include:

1. The high, low, and average price paid for each lot component under each exchange basis;
2. The cattle marketing weight trend;
3. A carcass grading summary taken from the kill reports of packers slaughtering cattle during the preceding week;
4. The U.S.D.A. estimates of cattle deliveries around the country under all marketing methods.

2) **Characteristics the remote data receiver should possess**

To perform these sale bill communication functions the RDR should possess the following characteristics.

a) **Written copies of transmissions**  The RDR should be capable of receiving, translating, and printing the transmissions from the CPU such that the data can be studied later by packer-buyers.
b) **Accommodate lengthy transmissions**  The RDR must have the capacity to receive lengthy transmissions of information within a short time period. If auction sale bills can not be dispatched until the morning of the particular auction session, the dispatched information must reach the bidding stations and be printed in time for each firm's buying representatives to study the sale bill and determine which lots the firm is interested in bidding on.

c) **Remote operation**  The RDR must be able to operate several hundred miles away from the location of the central processing unit.

d) **Computer coordinated**  To expedite the transmission of all the lot details in each lot's lot description it would be desirable for the RDR to be linked directly to the CPU. Accordingly, the CPU could directly transmit the lot description for each lot consigned for the particular auction session without the possibility of error during an intermediate human translation step.

e) **Confidentiality of transmissions**  Although much of the information dispatched over the remote data transmission network will be generally distributed to all regular buyers, the transmission of a particular bidder's purchase list must be sent only to the particular bidder's RDR. Thus, the communication network must be capable of transmitting confidential information to only one designated bidding station, while also maintaining its general dispatch capabilities for other types of information releases.

3) **Alternative devices presently available to perform the sale bill communication functions**  At least two presently available electronic hardware units, the teletypewriter and the computer line printer terminal,
appear to be capable of performing the sale bill communication functions.

a) **Teletypewriter terminals**  
The use of teletypewriter terminals would permit each bidding station to receive printed data directly from the central processing unit at a rate of ten characters per second. [4, p. 509; 6, p. 119] Because time is not of the essence in transmission of the sale bills, the teletypewriter terminal would appear as a feasible means of receiving the auction sale bill transmissions from the CPU.

b) **Line printer terminals**  
An alternative, somewhat faster and more expensive transmission of sale bills could arise from the use of a line printer terminal. A number of usable line printer terminals utilizing various printing mechanisms are presently available. The printing mechanisms frequently being employed in line printer terminals include: horizontal, vertical, and circular type bars; cylindrical printing drums, and rotating type chains. Due to the different printing devices employed, impact printers vary in output speed from 100-2000 lines per minute. [4, p. 193] While printers with output capabilities at the upper end of this spectrum are not necessary for performance of the sale bill communication function, such printers would be workable.

The main types of line printer terminals being marketed today are briefly described below.

1. **Bar printers**  
Bar printers use a series of vertically rising type bars resulting in a relatively slow output, varying from 100 to 150 lines per minute. [6, p. 119]

2. **Comb printers**  
Comb printers utilize a set of type characters mounted on a solid bar placed horizontally in front of the paper. To print, the bar slides from left to right, with hammers striking the desired characters. Comb printers attain output speeds of up to 150 lines per minute. [6, p. 122]
3. **Wheel printers** The wheel printers, which have a series of circular type bars aligned horizontally, attain a maximum output of 150 lines per minute. [2, p. 278; 6, p. 120]

4. **Drum printers** Drum printers, which have embossed characters placed on a cylindrical drum, attain speeds of from 700 to 1600 lines per minute. [6, p. 120]

5. **Chain printers** Chain printers utilize a horizontally rotating chain containing a series of type slugs. Hammers are activated behind the paper forcing the desired type slug on the rotating chain against the ribbon and paper to form the printed characters. Chain printers attain speeds of from 600 to 1300 lines per minute. [2, p. 278; 4, p. 194; 6, pp. 120-21]

d. **Remote data transmission function** Because the proposed ESPSCA will operate with consignors located at their remote production sites and packer-buyers located at remote bidding terminals, the electronic marketing system must accommodate the transmission of consignment and bidding data over great distances. Transmission of data between geographically remote input/output sites and the CPU, commonly referred to as "teleprocessing", could be accommodated by the use of a combination of communication channels.

For example, a Wide Area Telecommunications Service (WATS) system which utilizes normal telephone channels but at lower per call rates than regular long distance service, could link the remote producer consignment terminals with the CPU's audio-response unit. Leased teletype channels, which are capable of transmitting 5 to 20 characters per second, could link teletypewriters at bidding terminals with the CPU. [6, p. 128] Leased voice-grade telephone channels, capable of transmitting data at about 300 characters per second, could be used to communicate with remote on-line input/output units such as teletype consignment terminals and cathode-ray...
tube bidding terminals. [6, p. 128]

e. **Bidding functions** The bidding functions require that an electronic device called a "bidding terminal" enable bidders to electronically enter bids during each ESPSCA session. Ideally, the bidding terminal will be capable of remote operation such that bids can be entered on the ESPSCA via a bidding terminal located in each bidder's office.

Before selecting an electronic component to perform the bidding function, it is first necessary to identify the functions which each bidding terminal should be able to perform. Secondly, it is necessary to describe the desirable characteristics which the bidding terminals should possess. Third, it is necessary to consider the possible electronic components which could be designed to perform the bidding functions. And finally, I will describe the cathode-ray tube display station which is an electronic device that conceivably could serve as a bidding terminal.

1) **Functions to be performed by the bidding terminal** In addition to facilitating the entry of bids during each ESPSCA session, each bidding terminal must be able to perform the following bidding functions.

a) **Bidding terminal tells the bidder whether he was the last bidder on the lot at which he is looking** Once a bidder places a bid on a lot he will want to know that his bid has been registered and when he has subsequently been outbid. Thus, the bidding terminal must be able to give the individual bidder this information. This function must be performed in order to prevent the bidder from erroneously trying to outbid himself.
b) **Bidding terminal gives each bidder his bidding status**

Due to the simultaneous nature of the auction, each bidder will probably be bidding on several lots concurrently, and probably watching the price trend on several more lots at the same time. Because a bidder may rapidly be outbid, it is desirable that the bidding terminal rapidly tell the individual bidder on which lots he continues to be the last bidder, and on which lots he has been outbid. Performance of this function will expedite the auction process because otherwise the bidder would have to manually copy the entire bid array for each lot on which he bids in order to later determine whether he has subsequently been outbid.

c) **Give starting and closing signals**

Each bidding terminal must be able to receive signal transmissions from the CPU, and then, through flashing or colored lights, give bidders signals which indicate that an auction session has begun, that an auction session is about to end, and that an auction session has ended.

2) **Desirable characteristics the bidding terminals should possess**

There are at least six characteristics which each bidding terminal should possess in order to accommodate the simultaneous bidding on numerous lots of cattle during an ESPSCA session.

a) **Each bidder has a bidding terminal**

To permit competitive bidding, it is desirable that each regular bidder have his own bidding terminal, fully equipped to enter bids on the ESPSCA. This means not only that the cost must be such that he feels he can afford his own bidding terminal, but also that the centralized processing unit can handle the many incoming bids from the numerous bidding stations.
b) **Sensitivity and responsiveness of the bidding terminal**  
The bidding terminal must enable the CPU to readily distinguish between two bids made at almost the same point in time, on the same lot, and made by two different bidders at remote bidding terminals. In addition, the bidding terminals must assist the CPU in quickly identifying the bidder, the amount of the bid, the lot component on which the bid is being made, and the lot on which the bid is being entered. Furthermore, the bidding terminal must quickly respond to the bidder's request that he be able to look at another lot.

c) **Capability of bidding on each lot component**  
The bidding equipment must allow each bidder to bid on all of the lot components for any lot being auctioned. The existence of this characteristic is essential for the implementation of market-determined quality price differential schedules and combination trading bases.

d) **Allows bidder to view more than one lot bid array at the same time**  
Due to the simultaneous nature of the ESPSCA there likely will be a number of lots in each auction session which a bidder will be interested in buying and on which the bidder will want to closely follow price trends. Thus, it is desirable that the bidder be able to look at several lot bid arrays at the same time. This capability will allow the bidder not only to monitor the bidding in the several lots he is interested in, but will also enable him to compare each lot's quality price differential schedule.

e) **Viewing one lot component in all lots**  
To facilitate interlot price comparison it will be desirable for bidders to see and study the bid price for a selected type of lot component in each lot being sold
under the same trading basis.

f) Accommodating several buyers at one bidding station

For large packers it may be necessary to have several buyers, each operat-
ing similar bidding machines, or different parts of the same machine, con-
currently. However, when multiple bidder set-ups are utilized, the bidding
terminal system should be designed to prevent two different bidders,
employed by the same company, from bidding against each other.

3) Consideration of electronic devices which could be designed
to perform the bidding functions In trying to select an electronic bid-
ding device to serve as a bidding terminal, several possibilities including
the teletype and an electronic bidding board were considered but eventually
abandoned. The problem with the teletype network utilized by Johnson [16]
and the Canadian provinces [17] in the conduct of their regressive succes-
sive auctions was that one teletype machine could neither accommodate bid-
ing on more than one lot contemporaneously, nor permit the determination
of more than one price per lot contemporaneously.

Another possibility considered and subsequently abandoned was the de-
sign of an electronic bidding board. This electronic bidding board would
have been similar in size and arrangement to the chalkboard presented in
the previous section. However, instead of utilizing chalk, the conceived
electronic bidding board would have used banks of digital or light emitting
diode cells to display the numerical bids. The existing bid on each lot
component would then have been increased by the individual bidder's depres-
sion of the appropriate bidding buttons.

The electronic bidding board could have been deployed in several ways.
One deployment scheme would have located a central electronic bidding board
at the auction headquarters and assigned packer-buyers to closed booths in front of the board. Inside his assigned booth each packer-buyer would have a clear view of all lot bid arrays on the electronic bidding board and have access to a complete set of bidding buttons. However, the booth arrangement would restrict the bidder's vision such that he could not observe which lots his competing bidders were bidding on. A small bank of lights inside each booth would indicate the lots on which the individual packer-buyer was the last bidder.

Another configuration of the electronic bidding board would utilize a closed-circuit television network to broadcast an image of the central bidding board to the remotely located bidders. Under this configuration, the bidder's local packing company office would be equipped with a television screen to view the central bidding board over the closed-circuit television network and a set of bidding buttons which would enable the bidder to enter bids on any lot component in any lot. Whenever a button was depressed to enter an incremental bid, the bidder would be able to see it registered on the central bidding board via the television network.

Still another conceivable configuration of the electronic bidding board would locate a separate electronic bidding board in each buyer's office and have them interconnected through the central processing unit. The CPU would receive all bids and instantly record a bid increment entered by one packer-buyer on all of the remotely located bidding boards.

Despite all of the potentially deployable configurations of the electronic bidding board, implementation of such a system would be delayed because the board is not now in standard production. That is, before implementation would be possible, a considerable amount of engineering and pro-
programming would be required. In addition, the electronic bidding board system would be limited in the number of lots which could simultaneously be auctioned because it probably will not be economically feasible to construct a bidding board for more than 10 to 25 lots.

4) Description of the cathode-ray tube display station bidding terminal

Upon recognizing the infeasibility of both the teletype and electronic bidding board systems, I continued my search for an electronic bidding device. Further consideration led me to consider the possibility of using the graphic-display capabilities of the cathode-ray tube display station for performance of the bidding functions. Because graphic-display systems are designed to provide instant output from a digital computer by producing a visual display of recorded data now in main or secondary storage, and are readily available from a number of computer hardware manufacturers, the units appear to be ideally suited for use as bidding terminals. [5, p. 148] Upon further examination I realized that the versatility of these graphic-display units would permit the programming necessary to accommodate the simultaneous progressive auction. In addition, the cathode-ray tube can be readily incorporated into the computer-oriented auction system outlined above. Based on these considerations, the cathode-ray tube was the bidding device recommended for deployment in my electronic simultaneous progressive slaughter cattle auction proposal.

By itself, the cathode-ray tube looks much like a television tube. However, the cathode-ray tube is frequently incorporated into a console unit which has the input-control mechanisms used in determining what is to appear on the CRT screen. The three control devices which are combined with the CRT to comprise each graphic-display unit are: the alphabetic keyboard,
the programmed-function keyboard, and the fiber-optic light pen. Collectively, the cathode-ray tube and the complementary control devices are referred to as a "display station." When the input-control modes and the CRT are used together, the display station allows a user to enter data into the CPU, retrieve other data, and revise the recalled data.

This discussion now proceeds with a technical description of the components of the cathode-ray tube display station.

a) Cathode-ray tube The cathode-ray tube (CRT), the primary component in the graphic display system, is essentially a vacuum tube in which cathode rays are produced. [14, pp. 231-32] Cathode rays are streams of electrons projected from the surface of a cathode, a negatively charged electrode placed in the cathode-ray tube. [14, pp. 231-32] The visual display of information is produced on the face of the cathode-ray tube by the action of a stream of cathode rays being emitted from an electron gun and passing through a character stencil. [4, p. 212] The cathode rays then hit the phosphor coating on the interior surface of the cathode-ray tube, causing the coating to glow briefly. [5, p. 149] To retain the image on the cathode-ray tube screen, it is necessary to regenerate the image 30-50 times per second. [5, p. 149]

When only one CRT display station is to be installed at a bidding station, stand-alone cathode-ray tube models containing their own display controller may be installed. [1, p. 83] However, multiple deployment of CRT display stations at one bidding terminal normally requires the installation of a display control unit which permits each display unit to operate independently. [1, p. 83]

Because the CRT display station is a frequently utilized piece of com-
puter hardware, it is readily available for deployment in the ESPSCA. Accordingly, much engineering design and development of a previously non-existent electronic component is eliminated. Computer manufacturers presently market CRT display units in a number of sizes. For example, the IBM 2250 Display Unit Model 3, which operates through the IBM 2840-2 Display Control, features a twelve inch square central viewing area on the face of a 21 inch cathode-ray tube. The IBM 2840-2 Display Control will accommodate the installation of up to four IBM 2250 Display Units at one location. Another IBM display station model, the IBM 2260 Display Station, which operates through the IBM 2848 Display Control, features a 4 inch by 9 inch rectangular viewing area on the cathode-ray tube screen. The IBM 2265 Display Station combined with the IBM 2845 Display Control, features a 14 inch CRT on which a maximum of 960 alphanumerical characters can be displayed. Furthermore, the IBM 2265 can be obtained in two different display formats. One format provides 15 lines with 64 characters per line within a 10.4 by 4.8 inch frame. The other format provides 12 lines with 80 characters within a 10.4 by 3.12 inch frame. The IBM 2845 Display Control will accommodate the installation of up to 16 IBM 2265 Display Stations at one location. The basic IBM 3275 Display Station displays up to 480 characters in 12 lines of up to 40 characters each. Several larger models of the IBM 3275 Display Station are available, one of which displays up to 1920 characters. Because the IBM 3275 Display Station is able to stand alone without the use of a control unit, it is ideally suited for use in bidding terminals requiring only one display station.
b) Alphameric keyboard. Perhaps the least sophisticated of the three devices commonly available for control of the display station is the "alphameric keyboard." This input-control device is simply a typewriter keyboard consisting of the 26 letters of the alphabet, the ten numerals, and a few frequently used symbols. The operator of the display station uses the alphameric keyboard by typing in the desired command message or data, just as any typist types on a typewriter keyboard. As the message is composed, it is displayed on the cathode-ray tube screen for verification or editing. Subsequently, the message is transformed into electronic impulses and transmitted to the central processing unit and main storage unit.

When deployed as an integral component of each remotely located bidding display station, the alphameric keyboard will be used almost exclusively for the entry of nonrepetitive commands, such as the designation of Lot Identification Numbers. By use of the various alphameric and numerical character keys, the operating packer-buyer can keystroke the call numbers of each lot he wants to view on the cathode-ray tube screen. Almost all of the other cathode-ray tube control operating commands which would be used by an ESPSCA bidding station are repetitive and thus readily lend themselves to standardized programming. Because expediency in conduction of the auction is essential, the display stations will be programmed such that each programmable command may be entered by merely depressing the appropriate key on the programmed-function keyboard.

c) Programmed-function keyboard. The programmed-function keyboard, which may physically be described as a 32-key general-purpose keyboard, is the second input-control device frequently deployed with
cathode-ray tube units for use in controlling the display appearing on the cathode-ray tube's screen. During the installation of a programmed-function keyboard at a CRT display station, a computer programmer can prepare a series of specially-designed subroutine programs. Upon activation, each of these subroutines performs a desired operation on the display appearing on the CRT screen. Each key on the programmed-function keyboard is then assigned one of these programmed-function subroutines and hooked up such that depression of the key will activate the assigned subroutine.

When the CRT display station operator depresses a key on the programmed-function keyboard, a composed electronic impulse is transmitted from the keyboard over the exchange's teleprocessing network to the CPU. Upon receipt of the electronic impulse, the CPU deciphers the impulse message and identifies the desired programmed subroutine. Instantly, the CPU calls the specified subroutine and acting pursuant to the subroutine, transmits data for display or otherwise revises the displayed image appearing on the activator's CRT display screen by sending return transmissions over the teleprocessing network. Upon reaching the activating CRT display station, the transmissions cause the requested data or display modification to appear on the CRT display screen.

By use of the programmed-function keyboard at a CRT bidding terminal, the operating packer-buyer will be able to request that lot bid arrays be displayed on his CRT display screen, specify the bid increment represented by each bid and order various market news reports from the central processing unit. When the programmed function keyboard is properly implemented such that each button can direct the CPU to perform a specified operation via programmed subroutine, the use of the programmed-function keyboard, as
opposed to the alphameric keyboard, will expedite the bidding operations and lessen the time of each auction session.

d) Fiber-optic light pen The third input-control mode available as an accessory for many cathode-ray tube units is referred to as the fiber-optic light pen. The fiber-optic light pen is a pen-like device which enables the display station operator to identify to the computer program a particular line, point, or character in the displayed image. By moving the pen point to the part of the image he wants to identify and pressing the point against the CRT faceplate, the pen's switch is activated. Once activated, the pen will sense light at the point coming from the illuminated line or character at which the pen is pointed, thereby generating a signal for a programmed operation to be performed on the identified image. The light pen can be used alone or in conjunction with one or both of the keyboards in rearranging, deleting, or adding information to that shown on the screen. [5, p. 149]

When deployed as an integral component of each ESPSCA bidding terminal, the primary role of the fiber-optic light pen will be to identify to the central processing unit the lot characteristic in a particular lot's bid array on which the operating packer-buyer desires an incremental bid be entered. The exact increment represented by each such bid will be specified to the CPU by the operating packer-buyer's depression of the desired increment key on the programmed-function keyboard.

5. Proposed ESPSCA system design

Based on the foregoing assessment of the required component functions, the desired component characteristics, and the available electronic compo-
ents, I have selected certain electronic hardware components which I believe can be combined to achieve an operative electronic system for the conduction of the ESPSCA. Presented below is a function-by-function description of the proposed electronic system used to conduct the Electronic Simultaneous Progressive Slaughter Cattle Auction. In this description, an attempt has been made to illustrate how components of various capacities could be matched with the expected trading volume of producers, brokers, and packers. While reading this subsection, the reader should make frequent reference to Figure 4.5, which displays a flowchart of the proposed ESPSCA system.

a. Auction control function The auction control function would be performed by a high-speed digital computer (i.e. the central processing unit (CPU) and main storage unit (memory)), centrally located at the ESPSCA's headquarters. To accommodate audible transmissions to remote consignment terminals, the CPU would be equipped with an audio-response unit. When needed to supplement the main storage unit, auxiliary on-line storage units, such as magnetic drums, disks, or tapes, would be utilized.

b. Consignment function At the geographically remote production areas, moderate-sized cattlefeeders may install their own personal touch-tone telephone consignment terminals. Large-sized feedlot operators may instead decide to install card-dialing telephone consignment terminals. Rural banks and farm supply stores may obtain small, punched-card consignment terminals and make it accessible for a small per lot fee or as a complementary customer service. Consignment card files for the punched-card
Figure 4.5. Flowchart of the proposed design of the Electronic Simultaneous Progressive Slaughter Cattle Auction.
terminals could be prepared off-line by the use of specially perforated computer cards and a port-a-punch. Because all of the foregoing consignment terminals are capable of receiving only audible transmissions from the CPU, they would be connected with the audio-response unit at ESPSCA headquarters.

Brokerage firms which offer consignment services to producers unwilling to purchase their own consignment terminal, could buy or rent a teletypewriter consignment terminal. To facilitate rapid transmission of consignment data, these teletypewriter consignment terminals could be equipped to transmit from off-line prepared paper tapes.

c. Sale bill communication function Some participating packing companies, such as the moderate-volume packer in Figure 4.5, may choose to buy or rent a teletypewriter terminal to receive the daily sale bill transmissions from the CPU. Other packing companies, such as the large-volume packer in Figure 4.5, may instead equip their buying station with a line printer terminal to receive the sale bill transmissions.

d. Remote data transmission function Under the proposed ESPSCA system design, all of the consignment terminals capable of receiving only audible transmissions from the CPU (i.e. the touch-tone telephone, the card-dialing telephone, and the small, punched-card consignment terminals) would be connected with the audio-response unit at ESPSCA headquarters via WATS lines. Because the consignment brokers' teletype consignment terminals are

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30. The term "off-line" refers to the usage of peripheral hardware components, not operating under the direct control of the central processing unit, to prepare or process data for subsequent transmissions. [4, p. 22]
able to receive printed transmissions from the CPU, they would avert the audio-response unit and be connected directly with the CPU via leased voice-grade telephone channels. Teletypewriters installed at bidding terminals would receive transmissions from the CPU over leased teletype channels. All other hardware at each bidding terminal (i.e. the line printer and the cathode-ray tube display stations) would be connected with the CPU via leased standard voice-grade telephone channels.

e. **Bidding function** Located at each bidding station, in addition to one of the sale bill communication terminals, would be one or more cathode-ray tube display stations. Comprising each cathode-ray tube display station would be a cathode-ray tube, an alphameric keyboard, a programmed-function keyboard, and a fiber-optic light pen. In addition, multiple deployment of cathode-ray tube display stations usually requires the installation of a display control unit at the particular bidding terminals.

Moderate-volume packing companies would likely install only one cathode-ray tube display station, while larger volume packers are more likely to install multiple cathode-ray tube display stations. Brokerage firms which buy cattle for small-volume packing companies not equipped for participation on the ESPSCA may also install multiple cathode-ray tube display stations.

6. **Developing programmed-function subroutines for use during the auction's bidding stage**

Before presenting an overview of the conduct of an Electronic Simultaneous Progressive Slaughter Cattle Auction session, it is necessary to describe some of the programmed-function subroutines which will likely be
utilized by each participating packer-buyer during every auction session. All of these subroutines will be operational through each display station's programmed-function keyboard, and thus must be programmed prior to the commencement of bidding on the ESPSCA. The four basic types of programmed-function subroutines which must be programmed are: DISPLAY, DISPLAY TERMINATION, ERROR CORRECTION, and BID INCREMENT.

a. DISPLAY-type subroutines When programmed and operational, DISPLAY-type subroutines facilitate bidding by enabling packer-buyers to view specified lot bid arrays on the requesting packer-buyer's cathode-ray tube display screen. Frequently, a packer-buyer's interest will be in viewing the lot bid array for only one or two lots. However, at other times a packer-buyer will want to view as many lot bid arrays at the same time on the CRT display screen as the screen will accommodate. The number of lot bid arrays which a bidding station's CRT display screen can accommodate is dependent upon the size of the selected CRT display station and the composition of the lots for which lot bid arrays are desired. For the purpose of my proposal I will assume that a CRT with display screen accommodating a maximum of 960 characters (arranged in the format of 15 lines of up to 64 characters each) is the largest unit that is economically feasible for the ESPSCA. Accordingly, any columnar lot bid array must not require more than 15 lines. Due to the flexibility inherent in the CRT, the computerized bidding system can be programmed to fill the needs of the individual packer-buyer by offering subroutines which permit the viewing of between one and eight lot bid arrays simultaneously. Among the DISPLAY-type subroutines which could be programmed are: DISPLAY-1, DISPLAY-SPLIT-2, DISPLAY-SPLIT-4, DISPLAY-SPLIT-2-HORIZONTAL, DISPLAY-ONE COMPONENT, and DISPLAY-SPLIT-2-ONE.
COMPONENT.

Although each of the six DISPLAY-type subroutines will yield a different display configuration on a packer-buyer's CRT display screen, all DISPLAY-type subroutines would be programmed for activation through a similar five-step procedure. The steps comprising this procedure are as follows:

Step 1. DISPLAY subroutine designation    The display station operator (DSO) (usually the packer-buyer operating the bidding terminal) depresses the key on his display station's programmed-function keyboard which corresponds to the desired DISPLAY-type subroutine.

Step 2. Lot bid array specification    The display station operator would use his display station's alphameric keyboard to type the Lot Identification Number(s) pertaining to the lot(s) whose bid array(s) the particular packer-buyer wishes to view on this CRT display screen.

Step 3. Command completion    After typing the last alphabetic character in the last Lot Identification Number the display station operator wishes to include in a command message, the DSO should then indicate to the computer that the command is complete by depressing the period key on his alphameric keyboard. The "." appearing at the end of the command message indicates to the computer that the command message terminates with the period.

Step 4. Editing    Once the final character of the command message is typed, the display station operator would view each character of the command to verify its correctness as it appears on the display station's CRT display screen. If errors in the command message are observed, error correction procedures should be initiated.

Step 5. Transmission    Once certain that the DISPLAY-type subroutine command message is without error, the display station operator will then depress the TRANSMIT key on his display station's alphameric keyboard.

Once the TRANSMIT key is depressed the DISPLAY command, as shown on the CRT screen, is transformed into an electronic impulse and transmitted to the central processing unit over the exchange's teleprocessing network. Upon receipt of the transmission from a particular CRT bidding station, the CPU deciphers the electronic message to determine which DISPLAY subroutine
the requesting display station operator wants activated and which lot bid array he wants to view on his CRT screen. Pursuant to the DSO's command the central processing unit activates the designated DISPLAY subroutine. Upon activation, the DISPLAY subroutine calls the consignment file for the specified lot(s) from the computer's memory and transmits the lot identification heading (i.e. Lot Identification Number, producer's name if the Name Disclosure Option has been elected, and the number of head of each sex in the lot), the lot component price descriptions (i.e. "Steer Price", "Heifer Base", and "Choice YG 1-3 ≤ 660") and the present bid for each lot component price.

Having presented the DISPLAY subroutine activation procedure, my discussion now proceeds with a description of each of the proposed DISPLAY-type subroutines.

1) DISPLAY-1 subroutine

The least sophisticated DISPLAY-type subroutine is DISPLAY-1, which results in the display of one lot bid array on the utilizing DSO's CRT display screen. Because only one lot bid array is displayed under this subroutine, the CRT screen can accommodate a bid array of a steer, heifer, or mixed lot consigned under any of the seven trading bases (i.e. L, M, C, LM, MC, LC, and LMC).

To view one lot bid array via the DISPLAY-1 subroutine, the DSO should depress the DISPLAY 1 key on his display station's programmed-function keyboard. (Step 1 in the DISPLAY subroutine command procedure.) If the DSO wants to view the bid array for Lot No. 1005-LMC-M, he would then keystroke the following characters on his alphameric keyboard: "1005-LMC-M." After typing the last character of the command message, the DSO would then view the message as it appears on his CRT display screen, for verification and
After editing and transmission, the bid array for Lot No. 1005-LMC-M would appear on the requesting DSO's display screen as shown in Figure 4.7.

a) **Lot identification heading** For each lot bid array displayed under the DISPLAY-1 subroutine, regardless of the trading basis under which it has been consigned, the top line of the bid array will be the "lot identification heading." The "lot identification heading" may be comprised of three components: 1) the particular lot's Lot Identification Number; 2) if the consignor selects the Name Disclosure Option, the consignor's first initial and last name; and 3) the number of head of each sex in the particular lot. In Figure 4.7, the lot identification heading may be read from left to right to indicate that: 1) the lot's Lot Identification Number is 1005-LMC-M, 2) the consignor's name is F. Cattlefeeder, and 3) that the mixed lot is comprised of 150 steers and 50 heifers. For one-sex lots, only one head number is given. If in doubt, the packer-buyer can readily determine the sex of the animals by looking at the last letter in the Lot Identification Number (i.e. "S" indicates an all-steer lot, while "H" indicates an all-heifer lot).

b) **Lot component descriptions and prices** Beneath the lot identification heading in every lot bid array viewed under the DISPLAY-1 subroutine are the lot component descriptions and the current bid price on each lot component.

Whenever a lot is consigned on the liveweight basis, whether solely on this basis (See Figure 4.8) or in conjunction with other trading bases (See Figure 4.7), the bid array display for the lot under the DISPLAY-1 subroutine will include the heading "LIVEWEIGHT."
The DISPLAY-1 subroutine command message for Lot No. 1005-LMC-M as it would appear on the display station operator's cathode-ray tube display screen prior to transmission.
LOT NO. 1005-LMC-M F. CATTLEFEEDER 150/50

LIVEWEIGHT: STEER PRICE 0
HEIFER PRICE 0

IN THE MEAT: STEER BASE 0
HEIFER BASE 0

STEERS: CHOICE 1-3, \leq 660 0
CHOICE 1-3, > 660 0
CHOICE 4-5, \leq 660 0
CHOICE 4-5, > 660 0
GOOD 1-3, \leq 660 0
GOOD 1-3, > 660 0
GOOD 4-5, \leq 660 0
GOOD 4-5, > 660 0

HEIFERS: CHOICE 1-3, \leq 500 0
CHOICE 1-3, > 500 0
CHOICE 4-5, \leq 500 0
CHOICE 4-5, > 500 0
GOOD 1-3, \leq 500 0
GOOD 1-3, > 500 0
GOOD 4-5, \leq 500 0
GOOD 4-5, > 500 0

YOU WERE THE LAST BIDDER:

Figure 4.7. The appearance of a lot bid array for a lot consigned under the LMC trading basis as it would be viewed on the cathode-ray tube display screen under the DISPLAY-1 subroutine.
LOT NO. 1001-L-S  T. CATTLEFEEDER  50

LIVEWEIGHT: STEER PRICE  0

YOU WERE THE LAST BIDDER:

Figure 4.8. Before any bid has been entered the lot bid array for the all-steer Lot. No. 1001-L-S, which was consigned for sale only under the liveweight trading basis, would appear on the cathode-ray subroutine as shown above.
Depending on the sex of the consigned lot, the bid array display will also include the "STEER PRICE" lot component description (See Figure 4.8), the "HEIFER PRICE" lot component description, or both lot component descriptions (See Figure 4.7). Immediately following each lot component description as it appears on the cathode-ray tube display screen will be the current bid for the particular lot component prices. If no bid has yet been entered for the particular lot component, a zero (i.e. "0") will instead appear after the lot component description.

Whenever a lot is consigned on the "in the meat" basis, whether solely on this basis or in conjunction with other trading bases, the bid array display for the lot under the DISPLAY-1 subroutine will include the heading "IN THE MEAT." Depending on the sex of the consigned lot, the bid array display will also include the "STEER BASE" lot component description, the "HEIFER BASE" lot component description, or both lot component descriptions. See Figure 4.7.

Whenever a lot is consigned on the carcass grade and weight basis, whether solely on this basis or in conjunction with other trading bases, the bid array display for the lot under the DISPLAY-1 subroutine will include the heading "CGW." If the consigned lot is comprised only of steers, the bid array will include the heading "STEERS" and the following lot component descriptions:

- CHOICE 1-3 ≤ 660
- CHOICE 1-3 > 660
- CHOICE 4-5 ≤ 660
- CHOICE 4-5 > 660
- GOOD 1-3 ≤ 660
- GOOD 1-3 > 660
- GOOD 4-5 ≤ 660
- GOOD 4-5 > 660
If instead the consigned lot is comprised solely of heifers, the bid array will include the heading "HEIFERS" and the following lot component descriptions:

- CHOICE 1-3 ≤ 500
- CHOICE 1-3 > 500
- CHOICE 4-5 ≤ 500
- CHOICE 4-5 > 500
- GOOD 1-3 ≤ 500
- GOOD 1-3 > 500
- GOOD 4-5 ≤ 500
- GOOD 4-5 > 500

If the consigned lot is a mixed sex lot, as is the case with Lot No. 1005-LMC-M shown in Figure 4.7, the bid array will include the lot component descriptions for both steers and heifers.

c) Last bidder indicator

Appearing at the bottom of every lot bid array viewed under the DISPLAY-1 subroutine are the words: "YOU ARE THE LAST BIDDER:" The purpose of this feature is to indicate to the individual packer-buyer whether or not he presently is the last bidder on the lot and thus whether he would stand to purchase the lot if the auction were to terminate before another bid is entered on the particular lot. If a packer-buyer who is presently viewing the particular lot's bid array was the last bidder on the lot, an illuminated "x" will appear on his cathode-ray tube display screen adjacent to the colon at the end of the "YOU WERE THE LAST BIDDER:" caption.

2) DISPLAY-SPLIT-2 subroutine

Another DISPLAY-type subroutine which could be used as an alternative to the DISPLAY-1 subroutine is DISPLAY-SPLIT-2. Upon activation, the DISPLAY-SPLIT-2 subroutine splits the activating DSO's CRT display screen vertically such that it will accommodate the contemporaneous viewing of two lot bid arrays, arising from lots consigned
under any trading basis. The display station operator would find this subroutine a desirable selection whenever he wants to view and/or compare the prices on two different lots at the same time.

The DISPLAY-SPLIT-2 subroutine is activated by the display station operator's depression of the DISPLAY-SPLIT-2 key on his display station's programmed-function keyboard. Immediately thereafter, the display station operator would use his alphanemic keyboard to type the Lot Identification Number of the two lots he desired to view. If the two designated lots were Lot Nos. 1003-MC-S and 1005-LMC-M, the resultant command message which would appear on the DSO's display screen for editing would be as follows:

"DISPLAY-SPLIT-2: 1003-MC-S, 1005-LMC-M." Immediately after transmission the activating DSO's cathods-ray tube display screen is split vertically in half. Subsequently, the bid array for the first lot designated in the command message, in this case Lot No. 1003-MC-S, appears in the left one-half of the screen and the bid array for the second lot designated in his command message, in this case Lot No. 1005-LMC-M, appears on the right one-half of the screen. See Figure 4.9.

In Figure 4.9, the reader will note that the arrangement of lot identification headings, lot component descriptions and prices, and the last bidder indicator are analogous to that under the DISPLAY-1 subroutine except for the fact that each bid array is allotted only one-half of the display screen. As is the case in Figure 4.9, the bid arrays displayed simultaneously via the DISPLAY-SPLIT-2 subroutine need not represent lots consigned on the same trading basis. It should also be noted that whenever a bid array for a mixed lot consigned on a trading basis which includes the car-cass grade and weight basis is viewed under the DISPLAY-SPLIT-2 subroutine,
LOT NO. 1003-MC-S  W. SMITH 100  LOT NO. 1004-LMC-M  J. JONES 15/25

IN THE  STEER BASE  0
MEAT:  LIVE-  STEER PRICE  0
WEIGHT:  HEIFER PRICE  0

CGW:  STEERS

CHOICE 1-3, ≤660  0
CHOICE 1-3, >660  0
CHOICE 4-5, ≤660  0
CHOICE 4-5, >660  0
GOOD 1-3, ≤660  0
GOOD 1-3, >660  0
GOOD 4-5, ≤660  0
GOOD 4-5, >660  0

YOU WERE THE LAST BIDDER:

CHOICE 1-3, ≤660  0  CH 1-3 ≤500  0
CHOICE 1-3, >660  0  CH 1-3 >500  0
CHOICE 4-5, ≤660  0  CH 4-5 ≤500  0
CHOICE 4-5, >660  0  CH 4-5 >500  0
GOOD 1-3, ≤660  0  G 1-3 ≤500  0
GOOD 1-3, >660  0  G 1-3 >500  0
GOOD 4-5, ≤660  0  G 4-5 ≤500  0
GOOD 4-5, >660  0  G 4-5 >500  0

YOU WERE THE LAST BIDDER:

Figure 4.9  A display of two lot bid arrays as they would appear on the cathode-ray tube display screen under the DISPLAY-SPLIT-2 subroutine.
it is necessary to shorten the carcass grade and weigh component price descriptions by abbreviating the words "CHOICE" as "CH" and "GOOD" as "G".

3) DISPLY-SPLIT-4 subroutine

A third DISPLAY-type subroutine, DISPLY-SPLIT-4, could be programmed to split the activating display station operator's cathode-ray tube display screen into four columns, thereby enabling a packer-buyer to observe and/or compare the bid arrays for four lots on his CRT display screen.

The DISPLY-SPLIT-4 subroutine can be activated by the operating packer-buyer's depression of the DISPLY SPLIT-4 key on his cathode-ray tube display station's programmed-function keyboard. Once this key is depressed the subroutine should be programmed to enable the operating packer-buyer to use his alphameric keyboard to type the Lot Identification Numbers of the four lot bid arrays he wishes to view. For example, the packer-buyer might type: "1001-LM-S, 1002-LM-H, 1003-C-S, 1005-LMC-S." The operating packer-buyer would then view the following command message on his CRT screen: "DISPLY SPLIT-4: 1001-LM-S, 1002-LM-H, 1003-C-S, 1005-LMC-S."

After verification and transmission, a tabular display, like that shown in Figure 4.10, would appear on the display screen. Under the DISPLY-SPLIT-4 subroutine, one set of lot component descriptions would appear along the left side of the screen. Spaced across the top of the screen would be the four Lot Identification Numbers. Lined-up in columns under each Lot Identification Number would appear the prices comprising the particular lot's bid array. In each lot column the current bids for the applicable lot

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31 The other data normally included in the lot identification heading must be omitted under the DISPLY-SPLIT-4 subroutine due to space limitations.
<table>
<thead>
<tr>
<th>LW:</th>
<th>STEER PRICE</th>
<th>0</th>
<th>X</th>
<th>X</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HEIFER PRICE</td>
<td>X</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>MEAT:</td>
<td>STEER BASE</td>
<td>0</td>
<td>X</td>
<td>X</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>HEIFER BASE</td>
<td>X</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>CGW:</td>
<td>CH 1-3, ≤660</td>
<td>X</td>
<td>X</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>CH 1-3, &gt;660</td>
<td>X</td>
<td>X</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>CH 4-5, ≤660</td>
<td>X</td>
<td>X</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>CH 4-5, &gt;660</td>
<td>X</td>
<td>X</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>GD 1-3, ≤660</td>
<td>X</td>
<td>X</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>GD 1-3, &gt;660</td>
<td>X</td>
<td>X</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>GD 4-5, ≤660</td>
<td>X</td>
<td>X</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>GD 4-5, &gt;660</td>
<td>X</td>
<td>X</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

YOU WERE LAST BIDDER:

Figure 4.10. The display of four lot bid arrays viewed under the DISPLAY-SPLIT-4 subroutine when at least one of the lots is consigned on the carcass grade and weight trading basis.
component prices under the trading basis (bases) each lot is consigned under, are lined-up with the appropriate lot component descriptions on the cathode-ray tube display screen's left side. In each lot bid array column, an illuminated "X" fills the space of any lot component price description not applicable for the particular lot.

The sex composition and trading basis of the four lots specified in the DISPLAY-SPLIT-4 command message will be determinative of the lot component descriptions which will appear along the left side of the screen. For example, if all four lots are steer lots consigned on either the liveweight, "in the meat," or liveweight-"in the meat" basis, neither the heifer component descriptions nor the carcass grade and weight component descriptions will be displayed. See Figure 4.11. If, however, one of the four lots specified is also offered on the carcass grade and weight basis, the CGW lot component descriptions will also appear. See Figure 4.10.

Due to the 15 line by 64 character CRT display screen constraint, there are two limitations on the types of lot bid arrays which may be viewed under the DISPLAY-SPLIT-4 subroutine. First, the bid array of any mixed lot consigned on the carcass grade and weight trading basis can not be viewed under this subroutine because the screen does not have enough space to accommodate the lot component prices for both steers and heifers. Secondly, if two or more lots, consigned on the carcass grade and weight basis are included in the same DISPLAY-SPLIT-4 subroutine command message, the two or

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32 A larger cathode-ray tube display screen could possibly permit the display of bids for mixed lots consigned on a carcass grade and weight basis.
Figure 4.11. The display of four lot bid arrays viewed under the DISPLAY-SPLIT-4 subroutine when none of the lots contain heifers and none of the lots are consigned on the carcass grade and weight basis.
more lots must be comprised of the same sex. Violations of either of these
constraints will result in an error message appearing on the packer's CRT
display screen after he depresses the TRANSMIT key.

4) **DISPLAY-SPLIT-2-HORIZONTAL subroutine**  A fourth subroutine
which could be programmed to provide a display similar to that of the
DISPLAY-SPLIT-4 subroutine is the DISPLAY-SPLIT-2-HORIZONTAL subroutine. The
DISPLAY-SPLIT-2-HORIZONTAL subroutine permits the operating packer-buyer to
simultaneously view and/or compare up to eight bid arrays consigned on either
the liveweight, "in the meat", or liveweight-"in the meat" basis. **[33]** After
the operating packer-buyer depresses the DISPLAY-SPLIT-2-HORIZONTAL key on
his programmed-function keyboard, the subroutine should be programmed to
enable the operating packer-buyer to use his alphameric keyboard to designate
the lot bid arrays he wishes to view. For example, a packer-buyer's specific-
ification might be as follows: "TOP: 1001-L-S, 1006-LM-S, 1009-L-S; BOTTOM:
packer-buyer would observe the following command message on his CRT display
screen for editing: "DISPLAY-SPLIT-2-HORIZONTAL: TOP: 1001-L-S, 1006-LM-S,
After transmission, the operator's CRT display screen would immediately be
split in half, horizontally, with those lots specified for the "TOP" in the
command message appearing in tabular format across the top one-half of the
screen, and those specified for the "BOTTOM" appearing similarly across the

**[33]** Due to the CRT display screen size constraint, no lot bid arrays for
lots consigned on the carcass grade and weight basis can be viewed under this
subroutine. If the display station operator violates this constraint, an
error message will appear on the DSO's cathode-ray tube display screen after
he depresses the TRANSMIT key.
bottom one-half of the screen. See Figure 4.12.

5) **DISPLAY-ONE COMPONENT subroutine**  
A somewhat different DISPLAY-type subroutine which should be programmed would enable the operating packer-buyer to view and/or compare bids for a similar lot component from each of fourteen lots. The DISPLAY-ONE COMPONENT subroutine would be a desirable selection if, for example, a packer-buyer wanted to compare and analyze the trend in bidding on the steer price for lots consigned under the liveweight basis. Accordingly, this packer-buyer could activate this subroutine by depressing the DISPLAY-ONE COMPONENT key on his display station's programmed-function keyboard. The subroutine should be programmed to then permit the operating packer-buyer to use his alphanumeric keyboard to type the following command which designates the trading basis, lot component price, and Lot Identification Number pertaining to the prices he wants to view. The resultant command might be as follows: "LIVEWEIGHT-STEER PRICE: 1101-L-S, 1102-L-S, 1103-LM-S, 1104-LM-M, 1105-L-S, 1106-LM-M, 1107-LMC-S, 1108-L-S, 1109-L-M, 1110-L-M, 1111-LM-S, 1112-LM-S, 1113-LMC-S, 1114-L-S."

After editing and transmission, the activating packer-buyer's CRT display screen would appear as shown in Figure 4.13. At the top of all displays under the subroutine would appear the name of the trading basis and the lot component price the operating packer-buyer requested. In Figure 4.13, "LIVEWEIGHT-STEER PRICE" indicates that the displayed bids represent the steer price component of lot bid arrays for lots whose consignment trading basis includes the liveweight basis. Listed beneath this heading in the order they appeared in the command message, are the Lot Identification Numbers and the corresponding current bid prices on the specified lot component.
<table>
<thead>
<tr>
<th>Lot</th>
<th>LW: STEER PRICE</th>
<th>LW: HEIFER PRICE</th>
<th>MEAT: STEER BASE</th>
<th>MEAT: HEIFER BASE</th>
<th>YOU WERE LAST BIDDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1101-L-S</td>
<td>45.25</td>
<td>x</td>
<td>76.50</td>
<td>73.25</td>
<td>x</td>
</tr>
<tr>
<td>1102-LM-M</td>
<td>45.00</td>
<td>42.25</td>
<td>76.75</td>
<td>73.25</td>
<td></td>
</tr>
<tr>
<td>1103-M-S</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>1104-L-S</td>
<td>44.75</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lot</th>
<th>LW: STEER PRICE</th>
<th>LW: HEIFER PRICE</th>
<th>MEAT: STEER BASE</th>
<th>MEAT: HEIFER BASE</th>
<th>YOU WERE LAST BIDDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1105-L-H</td>
<td>x</td>
<td>43.00</td>
<td>75.75</td>
<td>73.75</td>
<td>x</td>
</tr>
<tr>
<td>1106-LM-S</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>1107-L-S</td>
<td>45.50</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>1108-L-H</td>
<td>x</td>
<td>44.25</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4.12. Illustration of eight lot bid arrays displayed under the DISPLAY-SPLIT-2-HORIZONTAL subroutine.
Figure 4.13. Illustration of a display of fourteen liveweight basis steer prices under the DISPLAY-ONE COMPONENT subroutine.
6) DISPLAY-SPLIT-2-ONE COMPONENT subroutine

An extension of the concept underlying the DISPLAY-ONE COMPONENT subroutine results in the DISPLAY-SPLIT-2-ONE COMPONENT subroutine. Upon activation, the DISPLAY-SPLIT-2-ONE COMPONENT subroutine could be programmed to result in the operating packer-buyer's CRT display screen being split in half vertically, in order to accommodate two columns of fourteen lot component bids. In addition, this subroutine could be programmed to enable the operating packer-buyer to specify that prices for one lot component be displayed in the left one-half of the CRT display screen and prices for another lot component in the right one-half.

To activate this subroutine the operating packer-buyer would depress the DISPLAY-SPLIT-2-ONE PRICE key on his display station's programmed-function keyboard. Then, the subroutine should be programmed to enable the operating packer-buyer to use his alphameric keyboard to type a command message which designates the desired trading basis, lot component price, and Lot Identification Numbers. For example, the activating packer-buyer might type the command: "LEFT: LIVEWEIGHT-STEER PRICE: 1121-LM-S, 1122-LM-S, 1123-LM-M, 1124-LMC-S, 1125-LM-S, 1126-LM-S, 1127-LM-M, 1128-LM-S, 1129-LM-S, 1130-LMC-S, S, 1131-LM-M, 1132-LM-M, 1133-LM-S, 1134-LMC-S; RIGHT: MEAT BASIS-STEER BASE: SAME LOT IDENTIFICATION NUMBERS AS FOR LEFT ONE-HALF." The resultant CRT display might appear as shown in Figure 4.14.

b. DISPLAY TERMINATION subroutines

Whenever a packer-buyer has completed his bidding or analysis of a display resulting from a DISPLAY-type or auxiliary subroutine, some method of clearing the display from his CRT screen is needed. As a result of this need, I propose that two DISPLAY TERMINATION-type subroutines be programmed. The proposed subroutines are:
<table>
<thead>
<tr>
<th>LIVEWEIGHT - STEER PRICE</th>
<th>IN THE MEAT - STEER BASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1121-LM-S</td>
<td>1121-LM-S</td>
</tr>
<tr>
<td>1122-LM-S</td>
<td>1122-LM-S</td>
</tr>
<tr>
<td>1123-LM-M</td>
<td>1123-LM-M</td>
</tr>
<tr>
<td>1124-LMC-S</td>
<td>1124-LMC-S</td>
</tr>
<tr>
<td>1125-LM-S</td>
<td>1125-LM-S</td>
</tr>
<tr>
<td>1126-LM-S</td>
<td>1126-LM-S</td>
</tr>
<tr>
<td>1127-LM-M</td>
<td>1127-LM-M</td>
</tr>
<tr>
<td>1128-LM-S</td>
<td>1128-LM-S</td>
</tr>
<tr>
<td>1129-LM-S</td>
<td>1129-LM-S</td>
</tr>
<tr>
<td>1130-LMC-S</td>
<td>1130-LMC-S</td>
</tr>
<tr>
<td>1132-LM-M</td>
<td>1132-LM-M</td>
</tr>
<tr>
<td>1133-LM-S</td>
<td>1133-LM-S</td>
</tr>
<tr>
<td>1134-LMC-S</td>
<td>1134-LMC-S</td>
</tr>
</tbody>
</table>

Figure 4.14. Illustration of a possible display of the current bid on one particular lot component for fourteen lots and the current bid on another lot component for another fourteen lots under the DISPLAY-SPLIT-2-ONE Price subroutine.
1) the ERASER subroutine, and 2) the CLEAR subroutine.

1) ERASER subroutine The role of the ERASER subroutine would be to clear the activating packer-buyer's CRT display screen without terminating the underlying DISPLAY-type subroutine. Accordingly, the underlying DISPLAY-type subroutine remains operative and prepared to receive the packer-buyer's designation of another set of Lot Identification Numbers for bid arrays to be viewed under the same DISPLAY-type subroutines.

A packer-buyer who had completed his examination of one set of bid arrays under a certain DISPLAY-type subroutine and who wishes to readily view another set of bid arrays under the same DISPLAY-type subroutine would activate the ERASER subroutine by depressing the ERASER key on his programmed-function keyboard. Once activated, the ERASER subroutine would erase the previous image from the activating packer-buyer's CRT display screen. Subsequently, the ERASER subroutine would leave the underlying DISPLAY-type subroutine prepared to receive the packer-buyer's command message assembled on his alphameric keyboard, specifying another set of lot bid arrays which the packer-buyer now desires to view. Because the ERASER subroutine rather than the CLEAR subroutine was selected, the packer-buyer need not redpress the particular DISPLAY-type subroutine key before keystroking the new command message.

2) CLEAR subroutine The function of the CLEAR subroutine is to clear the activating packer-buyer's CRT display screen and terminate the previously operational DISPLAY-type subroutine.

Whenever a packer-buyer has completed his viewing of a set of lot bid arrays displayed under one DISPLAY-type subroutine and subsequently desires to analyze another set of lot bid arrays under a different DISPLAY-type
subroutine, the packer-buyer should activate the CLEAR subroutine. This activation is accomplished by depressing the CLEAR key on his display station's programmed-function keyboard. The activating packer-buyer could then proceed in ordering the new display by depressing the programmed-function keyboard key pertaining to the desired DISPLAY-type subroutine and entering the desired Lot Identification Numbers via his alphameric keyboard.

c. ERROR CORRECTION-type subroutines

In view of the potential for typographical errors in command messages and errors arising from the designation of lot bid arrays which can not be viewed under a certain DISPLAY-type subroutine, the need was recognized for an expedient method of command-message error correction. To facilitate rapid correction without retyping a lengthy command message it was recognized that the fiber-optic light pen could be used to identify the particular error to the CPU. Accordingly, the need has arisen for the development of two programmed-function subroutines: 1) the ERROR ERASER subroutine, and 2) the ERROR CORRECTION subroutine.

Upon activation, the ERROR ERASER subroutine would erase any individual or series of characters which appear on the activating packer-buyer's CRT display screen and which have been identified to the CPU. The characters to be erased could be identified to the CPU by having the packer-buyer point the tip of his display station's fiber-optic light pen at the erroneous characters. The packer-buyer who has discovered and erased an error would then activate the second subroutine in the error correction command sequence, the ERROR CORRECTION subroutine. Upon activation of the ERROR CORRECTION subroutine, the packer-buyer could use his display station's alphameric keyboard to type the corrective characters. The corrective characters would fill the space vacated by the erroneous characters, from left to right, in
the order typed. If the number of corrective letters exceed the number of deleted characters, the subroutine should be programmed to automatically widen the space by moving characters on the right side of the vacancy further to the right on the screen, or to the next line, if necessary.

The exact procedure for utilizing the two ERROR-type subroutines would be dependent upon the stage in the command procedure during which the particular error is observed. Two possible stages of error discovery are: 1) the editing stage - the error would be found by the Display Station Operator while editing the command message, and 2) the post-transmission stage - the error would be discovered by the central processing unit. The procedures for utilizing the two ERROR CORRECTION-type subroutines during these two stages are now discussed.

1) Editing stage error discovery: Errors discovered while editing the command message Typographical errors in command messages may frequently be encountered. For example, a Display Station Operator may accidentally type the erroneous Lot Identification Numbers "1202-LMC-S" when he intended to type "1022-LMC-S." If the DSO discovers such an error while editing the command message displayed on his CRT display screen, he should first depress the ERROR ERASE key on his programmed-function keyboard. The activating DSO can then use his fiber-optic light pen to identify for the CPU the erroneous characters in the command message as it appears on his CRT display screen. In the case of the exemplary "1202" and "1022" error, the DSO would point the fiber-optic light pen at the first "2" and the "0" that follows in the erroneous "1202" Lot Identification Number. As each erroneous character is identified, it is cleared from the computer's system and thus vanishes from the display system. After all erroneous characters
have been erased, the operating packer-buyer should depress the ERROR CORRECTION key on his programmed-function keyboard. The operator may then use the alphanemic keyboard to type out the corrective numerals: "0" and "2". As typed, the corrective numerals appear in the space vacated by the erroneous command components. The result is the desired Lot Identification Number, "1022-LMC-S". When the error corrections have been entered, the DSO may then continue as if no error had been made. Accordingly, he would depress the TRANSMIT key and view the requested lot bid array.

2) Post-transmission error discovery: Errors discovered by the Central Processing Unit

If an error, such as the specification of a Lot Identification Number pertaining to a lot bid array which is too large to be viewed under a particular DISPLAY-type subroutine escapes discovery during the editing stage, the CPU, upon deciphering the transmitted command, will discover the error and flash the appropriate error message on the erring operator's CRT display screen. For example, if a Display Station Operator transmitted Lot No. 1005-LMC-M in a command message for the DISPLAY-SPLIT-4 subroutine, the computer could be programmed to note that the operator had designated a mixed lot offered on the LMC basis, which can not be viewed under the DISPLAY-SPLIT-4 subroutine. Accordingly, the computer could flash an error message on the erring DSO's CRT display screen. This error message might read as follows: "TRANSMITTED DISPLAY-SPLIT-4 COMMAND MESSAGE INCLUDED LOT IDENTIFICATION NO. 1005-LMC-M. MIXED LMC BASIS LOTS CAN NOT BE VIEWED UNDER THE DISPLAY-SPLIT-4 SUBROUTINE." The CPU could then be programmed to redisplay the erroneous command message on the erring packer-buyer's CRT display screen. Thereafter, the DSO could follow the same procedure used for errors discovered during the editing stage. Accordingly, the DSO would use
the ERROR ERASE and ERROR CORRECTION subroutines, in conjunction with the fiber-optic light pen and the alphanemic keyboard, to enter another Lot Identification Number which is not in violation of the DISPLAY-type subroutine constraints.

d. BIDDING-type subroutines Once a packer-buyer has utilized the DISPLAY-type and ERROR CORRECTION-type subroutines to obtain the desired display of lot bid arrays on his CRT display screen, the packer-buyer's attention then turns to the entrance of a bid or bids on the bid arrays displayed on his screen. By use of his display station's programmed-function keyboard, in conjunction with its fiber-optic light pen, the packer-buyer will be able to enter the desired incremental bids on any lot component for any lot bid array displayed on his CRT. Because of the rapid communication abilities of the computerized auction network, bids entered are instantly received by the CPU, recorded in the particular lot's consignment file, and displayed on the CRT display screen of the bidder. At the same instant the new bid is displayed on the CRT display screen of any other packer-buyer who is watching the lot bid array for the same lot on his CRT.

1) Description of the BIDDING-type subroutines To facilitate bidding on the ESPSCA, the following BID INCREMENT subroutines should be programmed such that each may be initiated by the depression of a separate key on the display station's programmed-function keyboard. The BID INCREMENT subroutines, each representing a different bid increment which may be electronically entered, are as follows:

5¢ BID INCREMENT
10¢ BID INCREMENT
25¢ BID INCREMENT
Each of these subroutines represent an incremental bid in dollars per hundredweight. If a subroutine is activated to enter a bid on a liveweight basis lot component, the increment is interpreted in dollars per hundredweight of live animal. Otherwise, the bid increment is interpreted in dollars per hundredweight of carcass. In any event, the minimum bid increment allowed is $0.05 per hundredweight.

Another BIDDING-type subroutine which should be programmed is the BID INCREMENT CLEAR subroutine. This subroutine could be programmed to terminate the particular BID INCREMENT subroutine which a packer-buyer had been utilizing, without interrupting the DISPLAY-type subroutine presently being utilized by the display station.

2) Utilization of the BIDDING-type subroutines in the bidding process

To help the reader understand the role of these bidding subroutines, I now discuss their role in the bidding process.

Each BID INCREMENT subroutine should be programmed such that for a
particular CRT display station it is activated upon the operating packer-buyer's depression of the desired BID INCREMENT subroutine key on his programmed-function keyboard. Upon activation of a BID INCREMENT subroutine, the system is prepared to enter an incremental bid of the amount represented by the particular activated subroutine. The bid could be entered on any lot component of any lot which is presently being viewed on the bidder's CRT display screen. The bidder indicates the desired lot and lot component to the CPU by pointing the tip of his CRT display station's fiber-optic light pen at the last-digit character in the present bid for the particular lot and lot component, and subsequently pressing the fiber-optic light pen point against the CRT's faceplate. Upon identification, the CPU, acting pursuant to the particular BID INCREMENT subroutine, records the incremental bid for the particular lot component in the lot's consignment file. In addition, the CPU identifies the CRT display station at which the bid was entered and records the bidder's identification number in the LAST BIDDER memory space of the lot's consignment file. Furthermore, the packer's identification number is recorded adjacent to his incremental bid in the appropriate consignment file's lot component space along with a bid sequence number. This enables the computer to identify the source of each bid and the sequence in which it was entered such that if a packer-buyer subsequently withdraws a bid, the computer can identify his bid and the lot component bid which preceded it.

Throughout this bidding process a DISPLAY-type subroutine will read the present bid prices for the previously specified lot from its consignment file

34In some cases the last bid will be "0" indicating that no previous bid has been entered. In this case, the bidder should point his fiber-optic light pen at the "0".
and transmit them to the bidder's CRT display station for display. Therefore, once the new incremental bid has been recorded in the bidding-record segment of the lot's consignment file, the new incremental bid will be transmitted to the bidders CRT display screen for display. Similarly, the incremental bid is displayed on the CRT display screen of other packer-buyers viewing the same lot bid array. In addition, because the lot file now reports that the bidder is the last bidder on the lot, this information will be transmitted to the bidder's CRT display screen and indicated by means of an illuminated "X" character appearing at the bottom of the particular lot's bid array.

Once this bid recordation process had been completed the bidder may choose to enter another bid of the same increment on a lot component in another lot bid array. In this case, the packer-buyer needs only to use his fiber-optic light pen to identify the lot and lot component on which the bidder wants the bid increment entered.

If instead the bidder wishes to enter a bid of another increment on another lot, the packer-buyer should cancel the previously used BID INCREMENT subroutine by depressing the BID INCREMENT CLEAR key on his programmed-function keyboard. Subsequently, the packer-buyer may depress the BID INCREMENT key pertaining to the incremental bid now desired.

7. Conduction of an ESPSCA auction session

So far in this section the reader has been introduced to the electronic equipment selected for use in my proposal and the basic programmed-function subroutines which should be developed for utilization during the bidding stage of the auction. Having covered this introductory material, the reader is now prepared for an overview of how one session of the Electronic Simul-
taneous Progressive Slaughter Cattle Auction might be conducted. As has been the case in previous sections, this presentation is divided into the preparatory, bidding, and closing stages of the auction session.

While reading this overview, it should be remembered that the underlying mode of price determination on the ESPSCA is the same as that used by the simultaneous progressive slaughter cattle chalkboard auction (NESPSCA). The ESPSCA differs only in that all processes are conducted electronically, rather than manually.

a. Preparatory stage of an ESPSCA session Any Iowa cattlefeeder interested in consigning a lot of cattle for sale on the ESPSCA can use his personal touch-tone telephone in his home or office to contact the centralized ESPSCA headquarters. When the connection has been completed, the cattlefeeder will be greeted by the CPU's audio-response unit. Using a pre-established code arrangement, the cattlefeeder can then enter his individualized producer identification number and request up-to-the-minute market information for cattle traded on a specified trading basis. Upon receipt of these transmissions, the CPU verifies that the requesting producer is a bona fide member of the exchange and obliges by verbally reporting the average, high, and low sale prices for cattle under the specified trading bases during the current and previous auction sessions.

If, after hearing the price trend report, the inquiring cattlefeeder decides to consign one or more lots, he would follow the standardized code

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Producers who decide not to purchase their own personal touch-tone telephone could have access to the ESPSCA via a telephone at a local bank, elevator, or farm supply store, for which the producer pays a small, per-use fee. Or, the producer could access the ESPSCA via independent broker.
directions in his consignor's manual in order to assemble and transmit the appropriate coded consignment instructions. The transmitted consignment message will instruct the CPU with regard to the following consignment terms:

1. Number of lots to be consigned;
2. Desired trading basis for each lot;
3. Number of head of each sex in each lot;
4. Location of the cattle at the time of sale;
5. Auction session for which consignment is being made;
6. Desired Delivery Interval;
7. Desired grading option;
8. Whether the producer elects the Name Disclosure Option;
9. Producer's designated Transportation Cost Schedule for each lot; and
10. Consignor's designated Reserve Bid for each single lot component lot.

Upon receipt of this consignment transmission, the CPU deciphers the message verbally repeats the consignment details for consignor verification, assigns each lot a Lot Identification Number, and records the data in the lot's consignment file. When required by the consignor's grading option selection, a grader will be dispatched and the grader's report will be included in the particular lot's consignment file.

As the next auction session approaches, the ESPSCA computer would prepare to compile an auction sale bill by compiling a list of lots consigned for sale during this auction session. Subsequently, the computer will categorize these lots by trading basis, sex composition, and designated Delivery Interval. The computer would then pull the data needed from each lot's consignment file to compile each lot description.

The computer would then transmit the sale bill to each remotely located packer-buyer station via the ESPSCA's teleprocessing network. This sale bill transmission is subsequently received and printed by each bidding
station's teletype or line printer.

Upon receipt of the printed sale bill, each bidding station's staff has an opportunity to study the lot descriptions of consigned lots and identify the lots their firm is most interested in procuring.

b. Bidding stage of an ESPSCA session  As the pre-arranged auction starting time approaches, each participating packer's ESPSCA buyer seats himself in front of his firm's CRT bidding console and bidding station control panel. At precisely the specified starting time a green starting light on each bidding station's control panel is illuminated, indicating to each packer-buyer that the current auction session has commenced.

Upon receiving the starting signal each packer-buyer who is operating a CRT display station will follow a five-step procedure in using this programmed-function and alphameric keyboards to enter command messages for DISPLAY-type subroutines. These commands will express each operating packer-buyer's desire to view one or more lot bid arrays on his CRT display screen. When the requested bid array(s) is (are) flashed on the requesting packer-buyer's display screen, he may view and analyze the then-existing bids. If the packer-buyer subsequently desires to enter a bid on a particular lot displayed on his screen, he would select the desired bid increment and depress the corresponding BID INCREMENT key on his programmed-function keyboard. The packer-buyer will then prepare to enter the bid by pointing his display station's fiber-optic light pen at the last illuminated character in the previous bid for the desired lot and lot component. The bid will actually be entered when the packer-buyer presses the point of his fiber-optic light pen against the faceplate of his display screen at this point.
Immediately after receipt and registry of the individual bid increment the display will reflect the new incremental bid and an "X" at the bottom of the appropriate bid array indicating that the particular packer-buyer is now the last bidder on the lot. In addition, the new incremental bid is registered on the CRT display screen of any other packer-buyer who also is viewing the particular lot's bid array.

This bidding procedure, analogous to the manual procedure followed by the participants in the chalkboard simultaneous progressive cattle auction, is repeated by all packer-buyers until they reach their bid authorization ceilings.

c. Closing stage of an ESPSCA session As the participating packer-buyers approach their bid authorization ceilings, the number of bids entered per minute will decrease. When bid entrance drops to a predetermined rate per minute, the CPU transmits a command to each bidding station which causes an amber warning light on the station's control panel to be illuminated. Upon illumination, this amber light would alert packer-buyers that the end of the session is approaching.

The actual termination of bidding could arise in several ways. It is conceivable that after the warning light is flashed, bidding activity will continually diminish, with eventually no more bids being entered. Accordingly, after a passage of 60 seconds without the entrance of a single bid, the CPU could automatically disengage itself from receipt of further transmissions from any CRT bidding stations and lock each bidding station's input modes. Subsequently, the CPU could cause a red light to be illuminated on the control panel of each bidding station, indicating that bidding has ceased.
flurry of last minute bidding by buyers, each trying to edge out another bidder, the amount of bidding permitted between the warning and termination stages may have to be limited to a specific time period.

Under either termination procedure, the cessation of bidding will be followed by the computerized comparison of reserve bids with the last bid price for each lot component and the placement of withdrawal calls. The CPU will then transmit a purchase list comprised of Lot Identification Numbers representing the lots purchased by a particular packer to his buying station via the ESPSCA's teleprocessing network and the bidding station's line printer. When each packer-buyer has been informed of his purchases, the CPU will then activate its audio-response unit and direct the making of confirmation calls to each consignor who had not already received confirmation via withdrawal call. During each confirmation call conversation, the audio-response unit will verbally inform the consignor whether his consigned lot(s) was (were) sold, the selling price, the trading basis under which the lot was sold, the identity and location of the purchasing packer, and the purchasing packer's telephone number. Upon receipt of his purchase list, each packer will be expected to telephone the consignor and make final delivery arrangements pursuant to his specified Delivery Interval.

8. Extensions to the basic ESPSCA proposal

Because the reader has now been exposed to the basic aspects of my ESPSCA proposal, I believe he is now in a position to appreciate an enumeration of possible system extensions. These extensions could be incorporated into the CRT display station's system in an attempt to more fully utilize the capabilities of this electronic marketing system.
The ESPSCA system extensions fall into two basic categories: 1) additional programmed-function subroutines, and 2) multiple CRT deployment.

a. Additional programmed-function subroutines

The types of additional programmed-function subroutines, in the order of which they are now discussed, include the following: 1) BID STATUS, 2) SESSION MARKET TREND REPORT, 3) UNDERPRICED, 4) DISPLAY-SCAN, and 5) BID WITHDRAWAL.

1) BID STATUS-type subroutines

Upon activation, the BID STATUS-type subroutine could be programmed to inform the individual packer-buyers of his present bidding status. That is, this subroutine would cause a list of the Lot Identification Numbers pertaining to the lots on which the individual bidder has placed the last bid, to be displayed on the particular bidder's CRT display screen. By using the BID STATUS-type subroutines a bidder would be able to rapidly determine how many lots he is likely to purchase and how many lots he must continue to bid on if he wants to procure the number of cattle needed by his packing firm. Because it is the last bidder on each lot who buys the lot of cattle, regardless of the last lot component on which the bid was entered, knowledge of this information will be important to each bidder. This will be especially true as the auction session approaches completion.

As previously presented, all DISPLAY-type subroutines would be programmed to project a symbolic indicator below a lot bid array whenever the bidder looking at that bid array on his CRT display screen was the last bidder on the lot. However, when a bidder is monitoring and bidding on several lots this indicator will not be a feasible means of giving him his overall bidding status. The deficiency arises from the fact that this pro-
posed last bidder symbolic indicator reports the packer-buyer's bidding status with respect to only one lot rather than all of the lots the bidder might have bid on during the auction session. Thus, as the auction session nears completion, the individual bidder will not have time to call up each of the lots he is trying to buy and see whether or not the symbolic last bidder indicator still appears. Therefore, the programmed-function BID STATUS report appears to be a desirable medium through which a bidder can be kept up-to-date on his overall bidding status.

The BID STATUS-type subroutine might be made available in several different versions. For example, the BID STATUS subroutine might be programmed to yield a CRT display which lists up to fourteen lots on which the activating packer-buyer has placed the last bid. See Figure 4.15. Another version, the BID STATUS-SPLIT-2 subroutine, could be programmed such that upon activation the particular packer-buyer's CRT display screen would be split in half, allowing two columns of up to fourteen lot identification numbers each to appear on the screen. Each lot identification number appearing on the screen would represent a lot on which the particular bidder has placed the last bid. Still another type of bid status report might be made available to bidders through the development of a BID STATUS-NO LONGER THE LAST BIDDER (BID STATUS-NLTLB) programmed-function subroutine. When the BID STATUS-NLTLB key is depressed on a packer-buyer's programmed-function keyboard, the CRT display screen is immediately divided into two halves. In the left half appears the listing of up to fourteen lot numbers representing those lots on which the particular bidder has entered the last registered bid. In the right one-half of the CRT display screen would appear a listing of the lot identification numbers of up to fourteen lots on which the bid-
YOU WERE THE LAST BIDDER ON THE FOLLOWING LOTS:

1004-C-M
1009-LMC-S
1017-LM-H
1018-L-M
1022-LM-M
1104-LMC-S
1112-L-S
1154-MC-S
1179-LMC-H
1231-L-S
1256-LMC-S

Figure 4.15. A display presented under the BID STATUS subroutine.
der has entered a bid during the auction session, but on which the bidder has since been outbid. See Figure 4.16.

Regardless of the form of BID STATUS-type subroutine the individual bidder selects to use, the information must remain confidential with only the individual bidder having access to the information included in his bid status report. Thus, upon receipt of a bidding status inquiry the CPU will have to identify the buying station requesting the information and transmit that station's status only to that particular station.

2) SESSION MARKET TREND REPORT subroutine To provide each packer-buyer with up to-the-second information on the overall pricing trend during the current auction session, the ESPSCA could offer a SESSION MARKET TREND REPORT programmed-function subroutine. Upon activation, this subroutine could direct the CPU to instantly compute a statistical market summary and flash these figures on the activating packer-buyer's CRT display screen. Pricing information included in this market report might include the high, low, and average bid price for each lot component under all trading bases at that very instant. See Figure 4.17.

3) UNDERPRICED subroutine Due to the selective viewing of lot bid arrays inherent in the use of the CRT bidding devices, bidders may inadvertently overlook some underpriced lots during each auction session. Some packer-buyers may attempt to identify these underpriced lots by scanning through the lot bid array for all lots being auctioned during the session. However, this repetitive process would consume a large amount of the buyer's time and provides no certainty that when the search is completed the identified lots remain underpriced.
Figure 4.16. A display presented under the BID STATUS—NO LONGER THE LAST BIDDER subroutine.

<table>
<thead>
<tr>
<th>YOU WERE THE LAST BIDDER ON LOT NO.:</th>
<th>YOU ARE NO LONGER THE LAST BIDDER ON LOT NO.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1006-L-S</td>
<td>1002-L-H</td>
</tr>
<tr>
<td>1009-LM-H</td>
<td>1008-LMC-S</td>
</tr>
<tr>
<td>1026-LMC-M</td>
<td>1034-C-S</td>
</tr>
<tr>
<td>1045-L-S</td>
<td>1054-L-S</td>
</tr>
<tr>
<td>1079-MC-S</td>
<td>1112-LM-M</td>
</tr>
<tr>
<td>1121-L-H</td>
<td>1124-L-S</td>
</tr>
<tr>
<td>1177-LMC-S</td>
<td>1156-LMC-H</td>
</tr>
<tr>
<td></td>
<td>1179-L-S</td>
</tr>
<tr>
<td></td>
<td>1202-LMC-S</td>
</tr>
<tr>
<td></td>
<td>1209-L-H</td>
</tr>
<tr>
<td></td>
<td>1222-L-H</td>
</tr>
<tr>
<td></td>
<td>1309-LMC-S</td>
</tr>
<tr>
<td></td>
<td>1334-L-S</td>
</tr>
</tbody>
</table>
### SESSION MARKET TREND REPORT

**LOT COMPONENT:** HIGH LOW AVE.

- **LW-STEER PRICE**
  - HIGH: 48.50
  - LOW: 42.25
  - AVE.: 45.50

- **LW-HEIFER PRICE**
  - HIGH: 46.00
  - LOW: 40.00
  - AVE.: 43.25

- **M-STEER BASE**
  - HIGH: 46.50
  - LOW: 43.00
  - AVE.: 45.25

- **M-HEIFER BASE**
  - HIGH: 45.00
  - LOW: 41.25
  - AVE.: 43.50

**CGW-STEERS**

<table>
<thead>
<tr>
<th>Component</th>
<th>HIGH</th>
<th>LOW</th>
<th>AVE.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 1-3, ≤660</td>
<td>46.75</td>
<td>43.00</td>
<td>44.75</td>
</tr>
<tr>
<td>CH 1-3, &gt;660</td>
<td>46.50</td>
<td>40.00</td>
<td>44.75</td>
</tr>
<tr>
<td>CH 4-5, ≤660</td>
<td>47.00</td>
<td>40.00</td>
<td>44.50</td>
</tr>
<tr>
<td>CH 4-5, &gt;660</td>
<td>45.00</td>
<td>41.00</td>
<td>44.40</td>
</tr>
<tr>
<td>GD 1-3, ≤660</td>
<td>46.00</td>
<td>42.00</td>
<td>43.75</td>
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<td>43.00</td>
</tr>
<tr>
<td>GD 4-5, &gt;660</td>
<td>45.25</td>
<td>40.50</td>
<td>43.25</td>
</tr>
</tbody>
</table>

**CGW-HEIFERS**

<table>
<thead>
<tr>
<th>Component</th>
<th>HIGH</th>
<th>LOW</th>
<th>AVE.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 1-3, ≤500</td>
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<td>46.00</td>
<td>40.25</td>
<td>43.00</td>
</tr>
<tr>
<td>CH 4-5, ≤500</td>
<td>44.75</td>
<td>38.75</td>
<td>42.25</td>
</tr>
<tr>
<td>CH 4-5, &gt;500</td>
<td>45.00</td>
<td>38.00</td>
<td>42.75</td>
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<tr>
<td>GD 1-3, ≤500</td>
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<td>37.25</td>
<td>42.00</td>
</tr>
<tr>
<td>GD 1-3, &gt;500</td>
<td>43.50</td>
<td>39.00</td>
<td>42.25</td>
</tr>
<tr>
<td>GD 4-5, ≤500</td>
<td>43.50</td>
<td>36.00</td>
<td>41.00</td>
</tr>
<tr>
<td>GD 4-5, &gt;500</td>
<td>43.75</td>
<td>37.50</td>
<td>40.75</td>
</tr>
</tbody>
</table>

---

Figure 4.17. A display presented under the SESSION MARKET TREND REPORT subroutine.
By the development of an UNDERPRICED subroutine, ESPSCA programmers could enable all packer-buyers to rapidly identify those lots being auctioned during the present session which are greatly underpriced. Conceivably, by the combined use of the UNDERPRICED subroutine and the alphameric keyboard a packer-buyer would be able to specify a lot component and trading basis for which the buyer would like to learn the identity of up to fourteen lots which are comparatively underpriced. Upon receipt of such an inquiry, the CPU could instantly compute this information and display the listing of Lot Identification Numbers representing the underpriced lots on the activating packer-buyer's CRT display screen. See Figure 4.18.

4) DISPLAY-SCAN-type subroutine One method of enabling a packer-buyer to rapidly view the bid arrays for a number of lots would be through the development of several DISPLAY-SCAN-type programmed-function subroutines. The DISPLAY-SCAN-1, DISPLAY-SCAN-2, and DISPLAY-SCAN-4 subroutines could be programmed to display a predesignated repertoire of bid arrays in sets of one, two, or four lot bid arrays at a time, respectively, on the activating packer-buyer's CRT display screen. Each one, two, or four bid array set could be displayed for a 45-second period. At the end of each 45-second period, each display would be automatically erased and replaced by a display of the next set of lot bid arrays in the repertoire. This process could be continued until all lot bid arrays in the station's predesignated repertoire have been shown. At that point the subroutine could be programmed to automatically redisplay all the repertory lot bid arrays in the same order.

When desired, the DISPLAY-SCAN subroutine should be programmed to allow the bidder to momentarily halt the scanning process by depression of a
Figure 4.18. A display presented under the UNDERPRICED subroutine.

THE FOLLOWING LIVEWEIGHT BASIS LOTS ARE UNDERPRICED:

1001-L-S
1002-L-H
1022-L-M
1029-L-S
1055-L-S
1066-L-H
1109-L-M
1154-L-M
1157-L-S
1187-L-S
1223-L-M
1244-L-H
1293-L-H
1347-L-S
DISPLAY-SCAN-HOLD key on his programmed-function keyboard. Upon activation this subroutine would temporarily discontinue the progressive display of bid arrays, enabling the packer-buyer to study a particular display for more than 45 seconds and/or to enter bids on certain lot components. Once this detailed analysis has been completed, the packer-buyer could depress the DISPLAY-SCAN HOLD RELEASE, thereby allowing the scanning subroutine to continue.

5) BID WITHDRAWAL subroutine In order to comply with section 554.2328(3) of the Iowa Code, a bid-retraction subroutine should be programmed which would enable a bidder to retract his bid on any lot at any time before an auction session is completed. Bid retraction could readily be accomodated through the development of a BID WITHDRAWAL subroutine for use in conjunction with the programmed-function keyboard and the fiber-optic light pen.

To prepare for activation of the BID WITHDRAWAL subroutine, the bidder should depress the CLEAR key on his programmed-function keyboard. The bidder should depress the DISPLAY-1 key and use his alphameric keyboard to specify the lot from which bid withdrawal is desired. When this lot's bid array is displayed on his CRT screen, the bidder should check to determine whether

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36 Section 554.2328(3), Iowa Code (1977), states that in any auction for the sale of goods, such as slaughter cattle, "[a] bidder may retract his bid until the auctioneer's announcement of completion of the sale...."

37 Expected actual use of the BID WITHDRAWAL procedure would be rare as the fast pace of the electronic auction would find an erring bidder who would otherwise desire to withdraw his bid, outbid before the withdrawal procedure can be initiated. In those few cases where a bidding error is made and the erring bidder is not outbid, the availability of the BID WITHDRAWAL subroutine would be a desirable feature.
the last bidder indicator, "X", still appears at the bottom of the lot bid array. If the "X" still appears, the bidder should depress the BID WITHDRAWAL key on his programmed-function keyboard and then point his fiber-optic light pen at the "X" indicator on his display screen. Upon this activation, the BID WITHDRAWAL subroutine should be programmed to perceive the identity of the withdrawing bidder and the lot on which withdrawal is desired. Then, the computer will have to search the bidding record segment of the lot's consignment file to determine what the increment of the bidder's last bid on the lot was and on which lot component the bid was entered. Once this is determined, the computer will subtract the increment from the lot component's current bid price and display this adjusted price on the withdrawing bidder's display screen. Also, the subroutine should be programmed to remove the withdrawing bidder's identification number from the last bidder file and re-identify the next to the last bidder on the lot. Additionally, the "X" indicating that the withdrawing bidder was the last bidder should be removed from his display screen.

Once the withdrawing bidder denotes the removal of the "X" symbol from the bottom of the lot's bid array and the reduction in the particular lot component's bid price, the bidder may regard his bid as withdrawn. Accordingly, he may depress the CLEAR key on the programmed-function keyboard. Thereafter, the bidder may proceed with his bidding, treating the withdrawn bid as though it had never been entered.

b. Multiple cathode-ray tube deployment

So far in my description of the ESPSCA I have assumed that each packer's bidding station was equipped with only one CRT display station and employed only one packer-buyer to
operate it. However, I think that in many buying offices, especially where the buying volume is great, it will be desirable to combine several independently operated display stations to form a bidding station with the capacity to accommodate a large-volume packer or broker. For example, if three CRT display units are procured, they can be clustered together for operation by one buyer. If the three screens are arranged in a half-hexagon arrangement, the buyer could be seated on a swivel chair and monitor the bidding or price reports being displayed on each of the three screens. Of course, if a packer sees the need, two or more clusters of three CRT display stations, each operated by a separate packer-buyer, may be deployed.

Because the use of a display control unit allows each CRT display station in the multiple deployment to operate independent of the next, a packer-buyer operating a cluster of three CRT display stations can call a different subroutine on each of the three stations. By use of a workable mixture of DISPLAY-type and auxiliary subroutines, a packer-buyer will be able to purchase large volumes of cattle.

To exemplify the possible coordination which could be achieved by a packer-buyer operating a three-unit cluster, consider the following display scheme: At the beginning of an auction session a packer-buyer interested in purchasing cattle consigned only on a liveweight basis might activate the BID STATUS-NLTLB subroutine on the display station on his left, activate the DISPLAY-SPLIT-2-HORIZONTAL subroutine on the center display screen directly ahead of him, and activate the DISPLAY-SPLIT-2-ONE COMPONENT subroutine on the display screen to the packer-buyer's right. With this display scheme, the packer-buyer will be able to view the bid arrays for eight different
liveweight basis lots, observe and compare the steer base price on 28 other all-steer liveweight lots, and monitor his status to see which lots he remains the last bidder on and those on which he had been outbid. When the desired bids have been entered on those lots appearing on the center screen, the ERASE key on the CRT display screen's programmed-function keyboard could be depressed, and the Lot Identification Number pertaining to eight more lots might be typed on the display station's alphameric keyboard. Whenever desired, the SESSION MARKET TREND REPORT subroutine could be activated on one display station such that the packer-buyer could learn the trend of bidding over the entire auction.

Although the above example of coordinated use between two or more cathode-ray tubes may be among the more commonly used, there are numerous other combinations of programmed-function subroutines which can be used concurrently by a cluster of display stations. The existence of so many coordinated operations which may be used by large buyers with CRT clusters, along with the ability to permit a total bidding operation by small buyers having only one CRT bidding machine, is a true indicator of the adaptability of this electronic bidding system.
V. COMPARATIVE EVALUATION OF ELECTRONIC EXCHANGE SYSTEMS

A. Introduction

Before the ESPSCA or any other electronic commodity exchange system is recommended for implementation, cattle producers and packers will want assurance that the recommended exchange will yield a better exchange environment and/or better exchange results than present exchange systems, and that the recommended exchange is the best suited of known electronic exchanges for the particular commodity marketing situation. Because the exchange environment and results have so many attributes and the relative importance of various attributes is likely to vary between situations, it is unlikely that one electronic exchange will be best suited for deployment in all situations.

To assist in determining those situations where deployment of the ESPSCA may be desirable and the comparative strengths and weaknesses of the ESPSCA relative to prior electronic exchange proposals, twenty potentially unfavorable attributes (i.e. "flaws") of the slaughter cattle exchange environment were identified in Chapter III. In this chapter the twenty flaws are used as the basis for a comparative evaluation of four types of proposed electronic exchanges: 1) telephone auctions, 2) teletype auctions, 3) computerized exchanges, and 4) the ESPSCA.

While the enumeration of slaughter cattle market flaws in Chapter III drew heavily from Sosnick's ideas [26], my usage of the flaws in this chapter differs from Sosnick in the sense that they are not criteria in themselves. Instead, I have chosen to articulate each flaw or undesirable attribute as an affirmative criterion statement which describes the desirable
status of the attribute. The reason for this divergence was that I think the "affirmative" criteria statements provide more useful guidelines in designing an exchange. Accordingly, these criterion statements more nearly achieve what Sosnick [26, p. 828] and Stigler [27, p. 504] have referred to as "a list of meaningful and manageable criteria."

For each flaw the evaluation is organized as follows. First, under the heading "problem" the attribute of the exchange outcome or environment, which is the basis or cause of the flaw, is briefly restated. Whenever possible, this discussion will identify indicators or measures of these attributes. Second, a criterion against which the measures or indicators may be compared, is articulated. For some attributes it may be sufficient only to indicate desirable directions of change in the measures. Third, in some instances it is possible to identify certain conditions the existence or nonexistence of which serve as useful guidelines in determining the extent to which the exchange proposal satisfies the criterion. And finally, the attribute measure(s) or indicator(s) for each of the individual exchange proposals is(are) compared to the criterion to determine whether or not the particular exchange proposal satisfies the criterion. These evaluative ratings are enumerated in Figure 5.1 and interpreted in the chapter summary.

B. Evaluation

Redundant transportation, nonproductive facilities, unnecessary handling, and uneven delivery of cattle at plants are four separate flaws arising from related attributes of livestock assembly. Because the guidelines, evaluation, and ratings for each of these attributes are identical, I will first state the problem and criterion for each attribute, and then
present the guidelines, evaluation, and ratings applicable to all four attributes.

1. **Redundant transportation**
   
a. **Problem** The possibility of incurring cross-hauling costs is indicated when an exchange system\(^1\) routes livestock through intermediate assembly points.

   b. **Criterion** An exchange system should allow producers the option of selecting marketing methods\(^2\) which eliminate unnecessary transportation.

2. **Nonproductive facilities**
   
a. **Problem** Required maintenance and operation of nonproductive facilities not only imposes unnecessary marketing costs on producers and packers, but also wastes resources.

   b. **Criterion** An exchange system should allow producers and packers the option of utilizing marketing methods which avoid the use of nonproductive facilities.

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\(^1\)As used in this chapter the term "exchange system" refers to a "transaction system" (defined in note 1 on page 78) which has been equipped with the appropriate hardware and trading rules for operational sale of a particular commodity.

\(^2\)The term "marketing method" refers to one of the modes of marketing a commodity through an exchange system. Each marketing method is comprised of a set of steps which a producer and exchange personnel must perform in order to complete the marketing process. Each possible combination of steps which will accomplish the marketing process through a particular exchange system constitutes a different "marketing method."
3. **Unnecessary handling**

   a. **Problem** Unnecessary livestock handling costs frequently arise from requirements that livestock be assembled, graded, sorted, and/or pooled prior to or after sale.

   b. **Criterion** An exchange system should allow producers and packers the option of selecting marketing methods which eliminate unnecessary livestock handling.

4. **Uneven delivery of cattle at plants**

   a. **Problem** Uneven daily cattle delivery causes unnecessary packer carryover costs and an incomplete utilization of the packer's human and capital resources. The potential for uneven cattle delivery is indicated when an exchange system requires assembly of livestock prior to sale.

   b. **Criterion** An exchange system should allow packers the option of procuring cattle through methods which permit them to schedule a uniform daily receipt of cattle at their plants.

   c. **Guidelines for determining criterion satisfaction** Each of these four criteria may be substantially satisfied when producers and/or packers are provided with the option of having their cattle sold while still in the feedlot, or alternatively, shipping them to an assembly station prior to sale. If presale assembly and feedlot sales can not be made optional, these criteria can still be satisfied to some extent when cattle are required to be sold while still in the feedlot. However, exchange systems which require presale assembly probably will not satisfy the criteria.

   d. **Evaluation** Four proposed electronic exchanges, the MFA feeder pig telephone auction, the MFA slaughter hog telephone auction, the Maine
egg auction, and the Ontario Hog Producers' slaughter hog teletype auction, fail to satisfy the redundant transportation, nonproductive facilities, and unnecessary handling criteria primarily because each exchange proposal requires that all producers deliver their commodity to an assembly point prior to sale. In addition, the MFA slaughter hog telephone auction, the Maine egg auction, and the Ontario Hog Producers' slaughter hog teletype auction fail to satisfy the uneven delivery criterion. Presale assembly of livestock is likely to cause each of the four flaws to arise. Furthermore, required presale assembly precludes the utilization of more desirable livestock routes or methods. The defects in each of the four exchanges could largely be eliminated if producers were allowed the option of selling their commodity while still on the farm. The MFA feeder pig telephone auction does not fail to satisfy the uneven delivery criterion because the exact date of feeder pig delivery to feedlots probably will not be crucial.

The Manitoba slaughter hog teletype auction, the Alberta slaughter hog teletype auction, and the ESPSCA substantially satisfy each of the four criteria because they provide the producers and packers with the option of incurring redundant transportation costs, nonproductive facility charges, unnecessary handling costs, excessive transaction costs, and uneven delivery at plants, by shipping livestock to an assembly yard prior to sale, or avoiding these cost by selling livestock while still in the feedlot.

The Iowa Sheep Producers' telephone auction, the I.D.A., Johnson's slaughter cattle teletype auction, Schrader's electronic egg exchange, Holder's slaughter hog computerized exchange, and Henderson's electronic feeder calf exchange satisfy these criteria to a lesser extent. Even though these exchange proposals do not provide producers (packers) with the
option of selling (buying) livestock either while still on the farm or after delivery to an assembly yard, these exchanges are somewhat desirable because by requiring the livestock to be sold while still on the farm redundant transportation costs, nonproductive facilities costs, unnecessary handling costs, excessive transaction charges, and the costs of uneven delivery at plants, are almost totally eliminated.

5. **Excessive transaction and marketing costs**

   a. **Problem**  Required marketing through a particular marketing method frequently causes producers to incur excessive costs in anticipation of exchange such as commission firm charges, auction charges, and consignment fees.

   b. **Criterion**  An exchange system should allow producers the option of using alternative marketing methods which avoid the incurrence of excessive costs in anticipation of exchange.

   c. **Evaluation**  The Ontario and Alberta slaughter hog teletype auctions fail to satisfy this criterion because under provincial law marketing through these auctions has been made compulsory for almost all resident pork producers. Due to the compulsory nature of these teletype auctions, producers have no choice but to pay the auction fee. Although the Manitoba slaughter hog teletype auction rules allow producers the option of marketing directly to packers or alternatively through the auction, this exchange also fails to satisfy the criterion because in either case producers are required to pay a standardized auction fee. The Ontario and Alberta auctions could satisfy this criterion only if the compulsory marketing requirements were abandoned and producers were allowed the option of utilizing other marketing methods with lower transaction costs. The Manitoba auction could satisfy
this criterion if producers electing to market directly to packers were not required to pay the same auction fee paid by producers using the auction.

All of the previously proposed telephone auctions and computerized exchanges, as well as the I.D.A., Johnson's slaughter cattle teletype auction, and the ESPSCA, substantially satisfy this criterion because they contemplate voluntary producer participation, and thereby allow producers the option of utilizing alternative marketing methods with lower transaction costs. 3

6. Costly search for cattle
   a. Problem Marketing methods or exchange systems which require visual inspection of cattle by packer-buyers prior to purchase force packers to incur the unnecessary costs of fielding a crew of buyers to evaluate cattle. These procurement costs include the cost of training buyers, the cost of inaccurate quality estimates made by buyers, as well as the cost of providing buyers with a car and an office. Besides requiring visual inspection of cattle, some exchange systems squander packer-buyer time by utilizing negotiation or progressive auction transaction systems rather

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3 Admittedly one weakness of this criterion is that satisfaction of the criterion worsens the "free-rider" problem. That is, by allowing producers the option of using alternative, lower cost marketing methods, an exchange system will encourage producers to become "free-riders," A "free-rider" avoids the payment of electronic exchange fees by entering agreements to sell their cattle directly to a packer at some price determined on the electronic exchange. In other words, these parties will rely on the electronic exchange for its price making capacity without paying their portion of the exchange's operating costs. Furthermore, because this action will result in a reduced volume of trading through the electronic exchange, some additional concern may be raised as to the representativeness of prices determined on the electronic exchange,
than the more expedient regressive auction.

b. **Criterion** An exchange system should allow packers the option of selecting less costly methods of procuring cattle.

c. **Guidelines for determining criterion satisfaction** This criterion may be substantially satisfied when an exchange allows packers the option of visually inspecting livestock or relying on live or carcass grading done by independent graders, and the option of utilizing several different transaction systems for determining exchange price. Electronic exchanges which make only one of these two options available may still satisfy the criterion to some extent. Even if an electronic exchange offers neither of these options, it may still satisfy the criterion to some extent if it requires that traders utilize the regressive auction transaction system and a carcass merit grading system which eliminates the need for prebidding visual inspection of the cattle. Exchanges which offer neither of the options and require use of some transaction system less expedient than the regressive auction or require packer-buyers to visually inspect cattle prior to bidding, probably fail to satisfy this criterion.

d. **Evaluation** All of the previously proposed telephone auctions fail to satisfy this criterion because they require that traders utilize the time consuming successive progressive auction transaction system and require that the traders rely on live animal grading performed by an independent grader rather than giving traders the option of visually inspecting the animals prior to bidding. Similarly, Holder's computerized slaughter cattle forward contract market and Henderson's electronic feeder calf exchange fail to satisfy the criterion because they require that traders utilize the time consuming bid-offer matching transaction system and require
that traders rely on carcass evaluation of purchased livestock.

Even though the I.D.A., Schrader's electronic egg exchange, and the ESPSCA do not allow traders the option of using a more expedient transaction system such as the regressive auction, these exchanges satisfy this criterion to some extent because they allow packers the option of relying on a live animal or carcass evaluation, or visually inspecting the livestock prior to bidding.

The Ontario, Manitoba, and Alberta slaughter hog teletype auctions, as well as Johnson's slaughter cattle teletype auction, satisfy this criterion to some extent because they require that traders utilize the successive regressive auction transaction system and they rely on carcass evaluation of purchased livestock.

7. Traders not allowed to select price basis
   a. Problem Failure to allow traders the option of utilizing either a live or carcass merit basis, as well as a market-determined or rigid quality price differential schedule, precludes utilization of potentially more profitable or otherwise more desirable alternatives.
   b. Criterion Traders should have the option of trading on either a live or carcass merit basis. Those traders electing a carcass merit trading basis should have the further option of utilizing either a market-determined or rigid quality price differential schedule.
   c. Guidelines for determining criterion satisfaction Because carcass evaluation is inherently more accurate than live animal grading, exchange systems which arbitrarily require that traders utilize a carcass merit trading basis are socially more desirable and accordingly may still
satisfy this criterion to some extent. By contrast, exchange systems which require use of a live trading basis will probably not satisfy the criterion. Even though an exchange system requires that either a market-determined or a rigid quality price differential schedule be used rather than making their use optional, the criterion may still be somewhat satisfied. However, required use of a market-determined quality price differential schedule is usually preferred to required use of a rigid schedule.

d. Evaluation

1) Availability of optional live or carcass merit bases

Three electronic exchanges, the MFA slaughter hog telephone auction, the Iowa Sheep Producers' telephone auction and the I.D.A., fail to satisfy the first portion of this criterion because each exchange requires that a live trading basis be utilized. The defects in each of these exchanges could be substantially eliminated if traders were allowed the option of utilizing either the live basis or a carcass merit basis.

The ESPSCA substantially satisfies this portion of the criterion because it allows traders the option of utilizing either a live basis or one of two carcass merit trading bases (i.e. carcass grade and weight or "in the meat").

The Ontario Hog Producers' slaughter hog teletype auction, the Manitoba slaughter hog teletype auction, the Alberta slaughter hog teletype auction, Johnson's slaughter cattle teletype auction, and Holder's slaughter hog computerized exchange satisfy the first portion of this criterion to a lesser extent because each proposal requires that livestock be sold only on a carcass grade and weight basis.

Evaluation of the MFA feeder pig telephone auction, the Maine egg auc-
tion, Henderson’s feeder calf exchange, and Schrader’s electronic egg exchange under this portion of the criterion is difficult because carcass grading of eggs or feeder livestock is impractical.

2) Availability of optional market-determined or rigid quality price differential schedules

None of the previously proposed telephone auctions, teletype auctions, or computerized exchanges satisfy the second portion of the criterion because none of them have been designed to accommodate a market-determined quality price differential schedule. Furthermore, due to the transaction systems and electronic equipment utilized by these proposals, they can not be modified to make market-determined quality price differential schedules available. In view of these restrictions, Holder’s proposal, which would permit four to twelve changes per year in the rigid quality price differential schedule, may be as close as these exchanges can come to achieving a market-determined quality price differential schedule.

In making this statement I recognize that exchange systems which utilize the successive progressive auction transaction system, such as the telephone auctions, do in a sense provide for market-determined quality price differentials. That is, these exchange systems permit bidders to bid lot prices up to different amounts with the lot price differentials reflecting in part the differences in quality of the individual lots. For example, if Lot A is known to be comprised of good quality units and Lot B is known to be comprised of poor quality units, bidders can impose a market-determined quality price differential by bidding a lower price on Lot B. Arguably, much of the price differential between that bid for Lot A and Lot B would reflect the lower quality of the units in Lot B.

The reader should make a distinction between the market-determined quality price differentials made between lots sold on successive progressive auctions, and market-determined quality price differential schedules established for each lot sold on the ESPSCA. Because only one price is determined for each lot sold on the successive progressive auctions, the only price differentials are those between the one price determined for each lot. By contrast, the market-determined quality price differential schedule determined for each lot sold under the carcass grade and weight basis on the ESPSCA is comprised of two or more different prices, each representing units of different qualities.
8. Feeders may not refuse packer bids without incurring excessive costs
   a. Problem  The required incurrence of excessive costs in refusing packer bids causes an imbalance in producer-packer bargaining power which may deter producers from refusing extremely low bids, and thus allow packers to force prices down.
   b. Criterion  Producers should have the option of refusing bids without incurring excessive costs.
   c. Guidelines for determining criterion satisfaction and evaluation

   When cattle are shipped to a central or regional assembly yard prior to sale, a producer who refuses to sell his cattle due to unacceptably low packer bids will be forced to either pay extra yardage fees for maintaining his cattle at the assembly yard until the next scheduled sale session or haul the animals back to his feedlot. By contrast, when cattle are sold while still in the feedlot, the producer will incur only the cost of feeding the animals until the next auction session. Accordingly, the guidelines, evaluation, and ratings for this criterion are the same as those for the "redundant transportation" criterion, discussed on pages 199 to 201 of this thesis.

9. Inadequate market information
   a. Problem  Restrictions on the coverage or accessibility of commodity market news promotes an inequitable distribution of market information which results in inefficient exchange. This inefficiency arises in part from the fact that to make optimal trading decisions participants need to know what marketing alternatives are available. Insufficient information precludes those alternatives of which the participant is unaware.
b. Criterion A marketing system should be able to provide all traders with a comprehensive report of the pertinent market news needed to help them make trading decisions.

c. Evaluation Better market price information is usually a by-product of centralized price determination. However, not all centralized price determining electronic marketing systems provide adequate dissemination of market price information. For example, the computerized exchanges which utilize the bid-offer matching transaction system, including proposals by Schrader, Holder, and Henderson, fail to satisfy this criterion because they do not provide adequate market information. Each of these computerized exchange proposals would allow a trader or media personnel to access the exchange through his touch-tone telephone and request market information for a designated trading zone and commodity grade. In response, the proposed exchanges would have the exchange computer give an audio report which consists of the following prices (all prices adjusted to allow for transportation costs from the producer's location): 1) the lowest seller offer on file; 2) the highest buyer bid on file; 3) the price at which the last transaction was consummated; and 4) the average exchange price during the current trading session based on a stated number of head or lots sold. [11, p. 13] The weaknesses in this market information disclosure are as follows: 1) it gives traders little idea of how representative the prices are of the day's pricing trend or the strength of these pricing positions; 2) it makes no disclosure of how many head of cattle have been offered for sale during the trading session at any price because no printed sale bill is compiled and disseminated to potential traders; 3) by giving only the highest bid and lowest offering price for a designated zone and grade, any
pricing trend can be covered up, especially due to the fact that these price quotations represent price extremes as opposed to the mean or median bid price and the mean or median offered price; and 4) price comparisons between grades are hampered, but not necessarily barred, because each disclosure is for only one grade, and thus the bidder will have to make a separate price report request for each grade with which he wishes to compare prices. These disclosure problems could be substantially eliminated by disclosing to each seller all of the outstanding bids, the number of head represented by each bid, all of the outstanding offers, the number of head represented by each offer, and the exchange prices for all sale transactions consummated so far during the trading session. Even if it is not technologically feasible to transmit all of this data over the telephone, the availability of market information could be greatly improved by disclosing the mean and median bids, the mean and median offer, the range of bids, and the range of offers.

By contrast, the telephone auction, teletype auction, and ESPSCA proposals, which avoid many of the weaknesses inherent in the computerized exchange proposals, satisfy this criterion. Each of the proposals in these three exchange categories provide for the dissemination of a comprehensive sale bill to each bidder prior to commencement of the daily auction session. The sale bills list and describe each consignment. In addition, buyers participating in telephone auctions hear each of the incremental bids as entered and are told the exchange price on each lot when sold. Similarly, buyers participating in teletype auctions are told the exchange price for each lot as it is sold (which is the one bid entered on each lot sold on the teletype auctions). Buyers participating in the ESPSCA can observe the
presently bid prices for any or all lots being auctioned simultaneously during an auction session. Furthermore, the ESPSCA bidders can obtain a continually updated statistical summary of market information through the use of several programmed market information subroutines. Producers contemplating consignments through the ESPSCA will be provided with a more complete statistical summary of pertinent market information than that provided producers by the computerized exchange proposals. For example, the information the ESPSCA would make available through the producer's touch-tone telephone would include: the highest, the lowest, and the mean bid price on each lot component under the designated trading bases; and the number of cattle consigned under a designated trading basis.

10. **Competing bids not rapidly disclosed**

   a. **Problem** The inability of a marketing system to rapidly reveal all competing bids on each lot offered for sale before the exchange price on any lot is determined reduces the flow of pricing information and thereby inhibits price comparisons between two or more lots. This reduction yields inefficient exchange outcomes because when traders are not aware of all the alternative cattle price bids on other lots, they are unable to make trading decisions which maximize their collective gains (i.e. optimal marketing decisions).

   b. **Criterion** Prior to the final determination of the exchange price(s) for any lot, a marketing system should permit disclosure to all potential bidders of all price bids on each lot offered for sale.
c. Guidelines for determining criterion satisfaction

Exchange systems which permit disclosure to all potential bidders of all price bids on each lot before the exchange price on any lot is determined, substantially satisfy this criterion because they allow interlot (lot-to-lot) price comparisons. Exchange systems which permit disclosure of only the competing bids on each lot before that lot's exchange price is determined, satisfy this criterion to some extent. This partial bid disclosure arrangement permits bidders to react to competing bidders' bids on a particular lot, and accordingly participate in the lot's price determination. Exchange systems which do not disclose the price bids on any lot before the exchange price of any lot is determined, fail to satisfy the criterion because no interlot price comparison or interactive participation in a lot's price determination is possible.

d. Evaluation

The three computerized exchange proposals which utilize the bid-offer matching transaction system and the five teletype auctions fail to satisfy this criterion.

The computerized exchanges fail to satisfy the criterion because the only bids which are ever revealed to a potential bidder are the highest bids on file for any of the lots offered in a particular grade category. Admittedly this minimal bid disclosure may be sufficient to inform a bidder of the current trend in prices if there is a rising price trend in bids entered such that each time a bidder inquires about the highest bid, a higher bid is disclosed. However, this bid disclosure arrangement could be very misleading when the first bid entered during a session is the highest bid entered during the session on the particular grade category and all successive bids are less than the highest bid. In this instance, the com-
puterized exchanges would continue to report the first bid as the highest bid and would fail to indicate whether subsequent bids had been entered and how far below the highest bid the subsequent bids were entered, or what was the price trend represented by the subsequent bids. Furthermore, these computerized exchanges do not disclose the exchange prices at which all trades are consummated. Rather, only the most recent exchange price and the average exchange price for the particular grade category during the exchange session, are disclosed. Accordingly, lot-to-lot price comparisons are not possible.

The teletype auctions, which utilize the successive regressive auction transaction system, fail to satisfy this criterion because the "regressive" attribute allows the first bid entered on each lot to determine the lot's exchange price. Subsequent disclosure of this first bid is inadequate because it is revealed after the lot's exchange price is determined. Accordingly, other bidders are prevented from reacting to the disclosed bid and participating in the lot's exchange price determination. The auction transaction system's "successive" attribute further hinders interlot price comparisons because the exchange price on one lot is determined before that of other lots.

Because the flaws in the computerized exchanges and the teletype auctions arise from the inherent nature of the transaction systems they utilize, the flaws can not be eliminated without substantial modification of the proposals.

The telephone auctions, which utilize the successive progressive auction transaction system, satisfy this criterion to some extent because the
"progressive" attribute allows disclosure of all bids entered on a lot before that lot's exchange price is determined. However, the pricing disclosure of the telephone auctions is limited by the "successive" attribute which, as in the teletype auctions, hinders interlot price comparison.

By contrast, the ESPSCA, which uses the simultaneous progressive auction transaction system, substantially satisfies this criterion. The reason for the ESPSCA's satisfaction of this criterion is twofold. First, as with the telephone auctions, the "progressive" auction transaction system attribute allows disclosure of all bids entered on a lot before the lot's exchange price is determined. Second, the ESPSCA's "simultaneous" attribute, which allows competing bids on a number of lots to be entered concurrently before any lot's exchange price is determined, enables lot-to-lot price comparisons.

Although the ESPSCA substantially satisfies this criterion, there is one problem caused by the simultaneous progressive auction transaction system which is worth noting. Because the simultaneous progressive auction transaction system allows competing bids on a number of lots to be entered concurrently, the individual bidder's mental registry of each bid may be impossible. This ESPSCA bid monitoring problem is further compounded by the use of market-determined quality price differential schedules and combination trading bases which permit the receipt of bids on more than one lot component for each lot. This mental barrier may in part be reduced by the use of sophisticated computer programs which assist the bidder in monitoring the bidding on specified lots and summarize the data on one of the bidder's cathode-ray tube display stations. By contrast, the telephone auctions are free of this bid monitoring problem because the "successive"
attribute of the successive progressive auction transaction system permits receipt of bids on only one lot at a time. Accordingly, all bidders are able to hear each incremental bid as entered over the amplified telephone network.

11. Not allowing all bidders to bid on every lot

   a. Problem If price is to play its proper role in the coordination of the cattle industry, it must be based on the pricing input of all possible bidders. Any pricing mechanism which imposes physical or spatial barriers that prevent all possible bidders from entering bids on each lot offered for sale will potentially distort the pricing signals and hinder price coordination in the industry. Failure to allow all potential bidders to bid on every lot may be indicated by reduced competition and interregional price discrepancies in excess of transportation costs.

   b. Criterion All potential bidders should be allowed to bid on every lot offered for sale.

   c. Evaluation All three computerized exchanges which utilize the bid-offer matching transaction system fail to satisfy this criterion. Specifically, these exchanges are Shrader's electronic egg exchange, Holder's computerized slaughter hog contract market, and Henderson's electronic feeder calf exchange. The flaw in these exchanges arises from an informational barrier inherent in the design of the computerized bid-offer

5The primary focus of this criterion and the accompanying evaluation is on whether the electronic hardware and transaction system utilized allow all bidders to bid on every lot. Consideration of whether the exchanges have been proposed for deployment in a state or regional area rather than nationwide (which is another factor that may bar some bidders from bidding on every lot) has thus been excluded form this discussion.
matching transaction system. As proposed, these exchanges would permit potential bidders to learn for any grade classification only the lowest producer offer on file, the highest packer bid on file, the price at which the last transaction took place, and the average transaction price during the present exchange session. Accordingly, the bidder would not know how many head or lots are offered in any grade category. Therefore, a bidder participating in one of these computerized exchanges enters his bid on any lot presently offered in the designated grade category, rather than on one selected lot. Because this flaw arises from the inherent nature of the bid-offer matching transaction system utilized by these three computerized exchanges, this flaw can not be eliminated by merely making minor modifications such as the release of a master sale bill prior to each exchange session.

All exchange proposals falling into the telephone auction, teletype auction, or ESPSCA categories satisfy this criterion. Not only do these proposed exchanges inform potential bidders of the identity and description of each lot offered for sale, but they also permit each bidder to designate on which lot(s) his bid(s) is (are) to be entered.

The ESPSCA may be criticized as not allowing a bidder to effectively bid on all lots offered for sale because so many lots are being auctioned simultaneously that it is physically impossible for a bidder to monitor and bid on all lots. However, the severity of this problem is minimal. Seemingly the important factor is that the ESPSCA permits a bidder to bid on any lot. Furthermore, it would be possible to reduce the number of lots being auctioned simultaneously by scheduling several subsessions during
which a portion of all the consigned lots would be auctioned simultaneously. In addition, it may be possible to program computerized equipment to assist a bidder in monitoring the bidding on each lot being auctioned simultaneously.

12. Disclosure of bidder's identity required
   a. Problem The possibility of collaboration among bidders is indicated when exchange regulations or mechanics require or permit the disclosure of any bidder's identity.

   b. Criterion Exchange regulations or mechanics should not permit or require disclosure of any bidder's identity to competing bidders either before or after a transaction is consummated.

   c. Evaluation Only two proposed electronic exchanges, the Maine egg auction and the MFA feeder pig telephone auction, fail to satisfy this criterion. The Maine egg auction clearly is defective under this criterion because each bidder was required to identify himself by name when he entered an incremental bid. Apparently no attempt was made to utilize secret identification code numbers which would have eliminated this flaw.

   Although the MFA feeder pig telephone auction did not cause a bidder's identity to be revealed to those bidders assembled at all bidder assembly points, this exchange nevertheless fails to satisfy the criterion because when a bidder assembled at one of the bidder assembly points entered a bid, his identity may have been readily apparent to all other bidders assembled at the same point. It should be noted that this flaw will be present in any telephone auction which requires bidders to assemble in mass, and can not be eliminated unless each bidder is assigned a private bidding booth.
which makes it impossible for other bidders to see when a particular bidder enters a bid.

All of the other electronic exchange proposals, including proposals from each of the four exchange categories (i.e. telephone auctions, teletype auctions, computerized exchanges, and ESPSCA) satisfy this criterion. Generally, these proposals satisfy the criterion through the utilization of secret bidder identification codes and/or electronic bidding machines located at the bidder's office which permit communication with the centralized exchange headquarters while preserving bidder anonymity.

13. **Disclosure of seller's identity not optional**

   a. **Problem** Exchange regulations which bar disclosure of a seller's identity denies him of the opportunity to differentiate his cattle on the basis of his favorable production reputation. Conversely, exchange requirements that the identity of all sellers be disclosed to bidders permit packer-buyer discrimination against producers having unfavorable production reputations, while at the same time disfavoring those packers without knowledge of certain producers' production reputations.

   b. **Criterion** Exchange rules should allow producer-sellers the option of having their identity disclosed to all bidders prior to commencement of the price determination process.

   c. **Guidelines for determining criterion satisfaction** Exchanges which have rules requiring compulsory disclosure or anonymity fail to satisfy this criterion.

   d. **Evaluation** All of the previously proposed telephone auctions and computerized bid-offer matching exchanges, as well as the Ontario Hog
Producers' slaughter hog teletype auction and Johnson's slaughter cattle teletype auction, fail to satisfy this criterion because they do not allow disclosure of any producer's name prior to sale of his consigned livestock. In addition, the I.D.A. fails to satisfy this criterion because its rules require the disclosure of each consignor's identity prior to the sale of his lot(s). The I.D.A. requires producer name disclosure in order to allow packers the option of inspecting any consigned lot in the producer's feed-lot prior to the auction. Almost all of these exchanges could satisfy the criterion if exchange rules were modified to make seller identity disclosure optional.

Three electronic exchange proposals, the Manitoba slaughter hog teletype auction, the Alberta slaughter hog teletype auction, and the ESPSCA, satisfy this criterion because they allow producer-consignors the option of having their names broadcast along with their lot descriptions to all potential bidders prior to commencement of the price determination process.

14. Accurate grading system not optional

a. Problem Failure to allow the utilization of accurate grading systems leads to an imprecise valuation of cattle and thus prevents optimization of traders' collective gains. However, required use of any particular grading system is undesirable because the cost of grading may exceed the value to the traders of the information provided by grading.

b. Criterion Trader should be allowed the option of utilizing grading systems that accurately reflect the relative quality of beef carcasses, live animal grading systems, or no grading system at all.

c. Evaluation Two exchange proposals, the Iowa Sheep Producers
telephone auction and the MFA slaughter hog telephone auction, fail to satisfy this criterion because they require that slaughter livestock be sold on the basis of live grading. Had these two proposals allowed traders the option of utilizing a carcass grading system, or even no grading system at all, they would have satisfied the criterion.

The Ontario, Manitoba, and Alberta slaughter hog teletype auctions, Johnson's slaughter cattle teletype auction, and Holder's slaughter hog forward contract exchange fail to satisfy this criterion because they require that livestock be evaluated on a carcass merit basis. While arguably the accuracy attained from carcass grading greatly exceeds the accuracy of live animal grading, the exchanges requiring carcass grading impose a burden on those traders for whom the cost of carcass grading exceeds its value. If these exchanges were slightly modified to allow traders the option of utilizing live animal grading or no grading at all, they would satisfy this criterion.

Although the MFA feeder pig telephone auction, Henderson's electronic feeder calf exchange, and the Maine egg auction involve commodities for which carcass grading is inappropriate, these exchanges fail to satisfy the criterion because they each require that one grading system be utilized and thereby fail to allow traders the option of not having the commodity graded.

By contrast, the ESPSCA and Schrader's electronic egg exchange substantially satisfy this criterion. The ESPSCA satisfies the criterion because it allows traders the option of utilizing one or more carcass grading systems, a live animal grading system, or no grading system at all.
Although carcass grading of shell eggs is not possible, Schrader's exchange satisfies the criterion because it allows buyers the option of deciding whether or not eggs will be graded.

The I.D.A. satisfies this criterion to some extent because it allows producers the option of having their cattle graded while still in the feedlot (live grading system) or selling their cattle without any grading. The I.D.A. would have more substantially satisfied the criterion had traders also had the option of using a carcass merit grading system.

15. Undesirable packer collaboration is allowed

   a. Problem Undesirable packer collaboration occurs when some packers enter one of several types of mutual agreements to cooperate which gives them greater bargaining power than producers or competing packers excluded from the agreement. The essence of an agreement to limit bidder competition may be that no party to the agreement will raise the bid on a lot on which another party to the agreement is presently the last bidder. Similarly, a collaborative agreement to restrict a certain packer's supply of cattle may provide that certain packers, not members to the agreement, shall always be outbid. The potential for such undesirable collaboration arises whenever exchange rules fail to preserve each bidder's anonymity. Whenever the undesirable collaboration occurs, the resultant imbalance in bargaining power acts as an impediment to effective competition because it allows artificial manipulation of commodity demand.

   b. Criterion The design of the exchange, the exchange regulations,
and the enforcement of the exchange regulations should deter or prevent bidder collaboration.

c. Guidelines for determining criterion satisfaction

Exchanges which attempt to preserve bidder anonymity both before and after sales transactions are consummated substantially satisfy this criterion. Because knowledge of bidder identity conceivably could provide a basis for bidder collaboration, those exchanges which do not preserve bidder anonymity probably fail to satisfy the criterion.

d. Evaluation

The evaluation and ratings for this criterion are the same as those for the "disclosure of bidder identity required" criterion, discussed on pages 218-19 of this thesis.

16. Unwarranted price fluctuation

a. Problem

Random fluctuation in the exchange price determined for successive lots (i.e. interlot price fluctuation) sold during one exchange session which does not reflect quality differences and/or buyers' diminishing interest in procuring more cattle, yields inequitable treatment of sellers, inefficient exchange outcomes, and an adverse division of gains. In addition, interlot price fluctuation complicates the formulation of bidding strategies and makes pricing differences associated with quality, location, and time, more difficult to perceive. The degree of random price

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6 Whether sufficient anticollaboration regulations are enacted and enforced may depend in part upon the nature of the market agency which is organized or selected to operate the particular electronic exchange. Thus, for my evaluative purposes, I will presume that a market agency would be selected to operate the exchange which would rigorously enforce anticollusion regulations and pursue violators.
fluctuation is measured by the variance in prices of lots sold during one exchange session.

b. **Criterion** Less interlot price variation is preferred to more.

c. **Guidelines for determining criterion satisfaction** Interlot price variation is likely to be lessened when a bidder knows how much he will have to pay to purchase a particular lot and how much he will have to pay to purchase other lots to be sold during the exchange session, prior to the time the exchange price for any of these lots is determined. If a bidder knows both types of price information, he will be able to compare the prices needed to purchase various lots, develop bidding strategies, and adjust subsequent bids accordingly. Therefore, when the transaction system utilized by an exchange makes both types of price information available to a bidder prior to the time the exchange price is determined, the exchange may substantially satisfy this criterion. However, if the exchange's transaction system does not make both types of information available to bidders, the exchange probably fails to satisfy the criterion.

d. **Evaluation** All of the previously proposed teletype auctions, telephone auctions, and computerized exchanges fail to satisfy this criterion.

Although the "progressive" attribute of the successive progressive auction transaction system utilized by the telephone auctions enables bidders to know the price they would have to pay for one lot before the exchange price for that lot is finally determined, the telephone auctions fail to satisfy the criterion because the "successive" attribute prevents the bidders from learning the price they will have to pay for lots to be
auctioned later in the session.

The teletype auctions, which use the successive regressive auction transaction system, fail to satisfy this criterion for two reasons. First, the "regressive" attribute, which means that the first bid entered on the lot determines the exchange price, prevents bidders from knowing how much they will have to pay to buy the lot until after the exchange price is determined. Second, the "successive" attribute, which means that the exchange price on lots is determined sequentially, prevents bidders from knowing the price they will have to pay for lots other than the one on which bids are presently being received.

Because the computerized exchanges reveal to each bidder the lowest producer offer for his delivery point, each bidder knows he may have to bid at least as high as the lowest producer offer in order to buy one lot. However, the computerized exchanges fail to satisfy this criterion because they do not reveal to bidders the price they will have to pay for other lots prior to the time the exchange price for the first lot is determined. That is, the bidder does not know whether another lot has been offered at the same price or how much higher the next lowest producer offer is.

By contrast, the ESPSCA, which utilizes the simultaneous progressive auction transaction system, substantially satisfies the criterion because the progressive attribute enables a bidder to know how much he has to pay in order to buy one lot before the exchange price on that lot is determined. In addition, the "simultaneous" attribute means that because other lots are being bid on concurrently, a bidder knows how much he has to pay in order to buy these other lots before the exchange price on any of these lots is
determined.

17. **Persistent maintenance of interregional price differentials in excess of transportation costs**

   a. **Problem**  Unit exchange prices at spatially separated assembly points or production sites which persistently differ by more than the unit transportation cost between the points are evidence of inefficient exchange outcomes.

   b. **Criterion**  Unit exchange prices at spatially separated assembly points or production sites should not persistently differ by more than the unit transportation cost between the points.

   c. **Guidelines for determining criterion satisfaction**  A reliable indicator of whether an exchange will satisfy this criterion is the amount and type of price information available to bidders prior to the time the exchange price of any unit is determined during an exchange session. For maximization of exchange efficiency a bidder needs to know the price he will have to pay for a similar quality commodity at different commodity assembly points or production sites and the cost of transportation between each of the commodity locations. The availability of this information is dependent upon the type of transaction system utilized by an exchange.

   When the transaction system utilized by an exchange makes both types of information available (i.e. prices bidder would have to pay at various assembly points and the transportation cost between the various points) to a bidder prior to the time the exchange price is determined, the exchange may substantially satisfy this criterion. However, if the exchange's transaction system does not make both types of information available to
bidders, the exchange probably fails to satisfy the criterion.

d. Evaluation The evaluation and ratings for this criterion are the same as those for the "unwarranted price fluctuation" criterion, discussed on pages 223-25 of this thesis.

18. Enabling legislation required

a. Problem Electronic exchange proposals dependent upon the enactment of enabling legislation suffer from the inherent constraints in the legislative process which may delay, dilute, modify, or totally refute needed legislation and accordingly burden the proposed system's implementation. When enacted, enabling legislation frequently includes provisions for government regulation, monitoring, and control. Such regulations, controls, or mandatory requirements arising from legislation may restrict participants' freedom of choice in selecting among exchange alternatives.

b. Criterion The implementation of a marketing system should not depend upon the enactment of enabling legislation.

c. Evaluation Only three electronic exchanges, the Ontario, Alberta, and Manitoba slaughter hog teletype auctions, fail to satisfy this criterion because their implementation depended on the passage of enabling legislation. These Canadian teletype auctions rely on two pieces of legislation. One piece of legislation requires that all hogs be sold on a carcass grade and weight basis and that quality price differentials be those legislated by the Canadian government. The second piece of Canadian legislation gives provincial producer boards the authority to make marketing through the board's commodity exchange compulsory.

All of the telephone auctions and computerized exchanges, as well as
the I.D.A., Johnson's slaughter cattle teletype auction, and the ESPSCA, satisfy this criterion because their implementation would not depend on the enactment of legislation. Furthermore, it should be noted that the telephone auctions have been able to operate successfully without enabling or regulatory legislation.

19. Establishment of a uniform commodity grading system required

a. Problem Exchange proposals which require the establishment and utilization of a uniform commodity grading system deny participants the opportunity to utilize alternative grading systems more appropriately suited to their individualized needs. Furthermore, the cost of retraining commodity graders to implement the new grading system may exceed the cost savings arising from the convenience and value of the increased grading accuracy attained through use of the uniform system.

b. Criterion Traders should have the option of utilizing one or more grading systems or no grading system.

c. Guidelines for determining criterion satisfaction

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7This "establishment of a uniform commodity grading system required" criterion is similar to the "accurate grading system not optional" criterion to the extent they both require that alternative grading systems be available. However, the intended focus of these two criteria is different. The primary focus of the "establishment of a uniform commodity grading system required" problem and criterion centers on exchange requirements that exchange participants utilize one particular uniform grading system. If the uniform grading system is new, these requirements force participants to retrain in order to effectively utilize it, rather than allow them the option of using alternative grading systems with which they are already familiar. The uniform grading system criterion poses no requirement that any of the grading system alternatives be accurate or precision methods. By contrast, the "accurate grading system not optional" problem and criterion focuses on the availability of a grading system with the degree of accuracy appropriate for the bidder's needs.
which require that one and only one uniform grading system be established and utilized, fail to satisfy this criterion.

For the purpose of evaluation, two distinctions should be made. First, a distinction should be made between circumstances wherein a uniform commodity grading system is imposed on all producers within the production area, from those circumstances where a uniform system is imposed only on all voluntary participants. The former circumstances fail to satisfy the criterion because they deny traders the option of selecting among one or more, or no grading system. The latter circumstances fail to satisfy the criterion not because they deny traders the option of using alternative grading systems, but because they deny participants the opportunity to utilize the exchange if they elect to utilize an alternative grading system.

A second distinction should be made between exchanges which would impose a new grading system with which no graders are familiar, and exchanges which would impose a uniform grading system which is presently used or known by a number of graders and traders. While the latter exchanges may result in less grader retraining costs, required use of either grading system would severely restrict trader alternatives and therefore both types of exchanges would fail to satisfy this criterion.

d. Evaluation All of the telephone auctions, as well as the Ontario, Manitoba, and Alberta slaughter hog teletype auctions, Johnson's slaughter cattle teletype auction, Holder's computerized slaughter hog contract exchange, and Henderson's electronic feeder calf exchange fail to satisfy this criterion. More specifically, the MFA slaughter hog telephone
auction, the Maine egg auction, the Iowa Sheep Producers' telephone auc-
tion, and Johnson's slaughter cattle teletype auction fail to satisfy the
criterion because they each require that all voluntary participants util-
ize a well-known grading system. The MFA feeder pig telephone auction,
Holder's computerized slaughter hog contract exchange, and Henderson's
electronic feeder calf exchange fail to satisfy this criterion because
they each require that all voluntary participants utilize a new or specially
developed grading system. The three slaughter hog teletype auctions in
the Canadian provinces of Ontario, Manitoba, and Alberta fail to satisfy
this criterion because they require that the carcasses of all hogs sold
in each of the provinces be graded by use of a well-known grading system.
It is conceivable that all these exchange proposals could be modified to
allow the use of alternative grading systems. However, it should be noted
that before the Canadian exchanges could be modified, the compulsory
Canadian hog grading law would have to be amended or repealed.

Only three exchange proposals, the I.D.A., the ESPSCA, and Schrader's
electronic egg exchange, satisfy this criterion. Schrader's exchange sat-
ifies the criterion because it would allow buyers the option of deciding
whether or not grading is to be required. However, Schrader's proposal
would restrict any buyer electing to have his eggs graded to the use of
only one shell egg grading system. [23, p. 21]

The I.D.A. satisfies this criterion because it would allow producers
the option of having their cattle graded with a live grading system or sold
without any grading.

The ESPSCA clearly satisfies this criterion because it permits traders
to elect the use of no grading system, the use of a live animal grading system, or the use of one or more carcass grading systems.

20. **Sophisticated trading rules**
   
a. **Problem** Excessive costs incurred in training market participants and developing bidding strategies tend to exclude potential participants, lower exchange volume, and worsen the free-rider problem.
   
b. **Criterion** Lower participant training and bidding strategy development costs are preferred to higher costs.
   
c. **Guidelines for determining criterion satisfaction** Without actual cost and expected return data it is almost impossible to precisely determine whether or not a particular electronic exchange proposal would satisfy this criterion. However, by considering several indicators it should be possible to predict the likelihood of an exchange satisfying the criterion and degree of criterion satisfaction. One of the indicators of the cost of training or retraining participants is the degree of change in the method of entering bids from that presently utilized in existing marketing methods. The degree of change may itself be indicated by the required use of sophisticated electronic equipment for bidding.

   The second indicator is the difficulty of developing bidding strategies for bidders utilizing an exchange. In developing bidding strategies a bidder needs to know the willingness of other bidders to buy a particular lot and their willingness to buy other lots prior to the time he bids on the one particular lot. The availability of this pricing information and thus the difficulty of developing bidding strategies appear to be related to the type of transaction system an exchange utilizes. Successive regressive
auction transaction systems make development of bidding strategies extremely difficult because they require that bidders enter bids without knowing either the willingness of competing bidders to buy the particular lot or other lots which will be auctioned later in the session. Successive progressive auction transaction systems alleviate part of the strategy development problems incurred by the successive regressive auction because the "progressive" attribute permits more than one bid to be entered on a lot before exchange price is determined. Accordingly, a bidder has some indication of the willingness of other bidders to buy this lot before its exchange price is finally determined. However, due to the "successive" attribute, bid strategy development with successive progressive auctions is still hampered by the lack of knowledge as to the willingness of other bidders to buy lots to be auctioned later in the auction session. The simultaneous progressive auction transaction system alleviates both of these informational deficiencies. The "simultaneous" attribute means that because bids are being received concurrently on other lots a bidder can determine the willingness of other bidders to buy the other lots. In addition, the progressive attribute of the simultaneous progressive auction allows a bidder to determine the willingness of other bidders to buy a particular lot, just as is the case with the successive progressive auctions.

The bid-offer matching transaction system also makes the development of bidding strategies difficult because bidders are only told the presently highest packer bid and the lowest producer offer. This information is sufficient to tell a bidder the willingness of one competing bidder to buy one lot. However, because the transaction system does not reveal the amount
of other bids entered on the same grade category, there is no indication of the willingness of other bidders to buy lots.

Exchanges for which the amount of participant training and difficulty of developing bidding strategies are minimal may substantially satisfy this criterion. If only the cost of training or the cost of developing bid strategies is minimal, the exchange may still satisfy the criterion to some extent. If an exchange appears unlikely to minimize either the retraining cost or the cost of developing bidding strategies, the exchange likely will fail to satisfy the criterion.

d. Evaluation All of the previous telephone auction proposals may satisfy this criterion to some extent because due to the similarity of the conduct of telephone auctions and auctions held at sale barns, the necessary retraining of bidders may be minimal. However, due to the telephone auction’s use of the successive progressive auction transaction system, telephone auctions cause some difficulty in developing bid strategies.

All of the previously proposed teletype auctions also may satisfy this criterion to some extent. Because the entry of a bid requires the depression of merely one button, only a brief orientation may be necessary to acquaint bidders with the successive regressive auction transaction system and the teletype bidding machines. However, the teletype auction’s degree of criterion satisfaction is limited because utilization of the successive regressive auction transaction system means that the development of bidding strategies will be very difficult.

The ESPSCA satisfies the criterion to some extent because its utilization of the simultaneous progressive auction transaction system alleviates many of the problems in developing bidding strategies. However, the ESPSCA's
use of sophisticated electronic bidding equipment means that bidders will need a substantial amount of training to be able to operate the bidding machinery.

The computerized exchanges may satisfy the criterion to some extent because the training required to teach bidders how to enter bids via the touch-tone telephone will be minimal. However, the computerized exchanges' use of the bid-offer matching transaction system means that the development of bidding strategies may be difficult.

C. Summary and Interpretation of the Comparative Evaluation

The purpose of this section is to attempt to obtain an overall rating of the exchange proposals examined in this chapter, to interpret the evaluative ratings derived in this chapter, and to identify some of the inherent weaknesses in this electronic exchange evaluation.

The foregoing evaluation of electronic exchange proposals on the basis of the twenty individual market criteria can perhaps best be summarized by the tabulation of ratings presented in Figure 5.1. However, these ratings alone give no indication as to the overall desirability of the individual exchange proposals. Accordingly, several approaches may be undertaken in order to convert the individual criterion ratings into a meaningful overall ranking of the thirteen electronic exchange proposals. One such ranking approach would be to sum the twenty-one ratings for each exchange (Figure 5.1) and rank the proposals on the basis of the rating total. Under this approach, the lowest possible total, indicating the most

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8In totaling the ratings in Figure 5.1, each "N" rating was counted as a "1" rating.
<table>
<thead>
<tr>
<th>Criteria</th>
<th>MFA Feeder Pig</th>
<th>MFA Slaughter Hog</th>
<th>Iowa Sheep Producers</th>
<th>Maine Egg</th>
<th>Ontario Hog</th>
<th>Manitoba Hog</th>
<th>Alberta Hog</th>
<th>L.D.A.</th>
<th>Johnson's Cattle</th>
<th>Schrader's Electronic Egg</th>
<th>Holder's Computerized Hog</th>
<th>Henderson's Electronic Feeder Calf</th>
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</thead>
<tbody>
<tr>
<td>1. <strong>Application of criteria to exchange is inappropriate</strong></td>
<td>2</td>
<td>3</td>
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<td>2. Telegraphic transmission and marketing costs</td>
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<td>4. <strong>Compliance with trading rules, including the avoidance of tendered bids</strong></td>
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<td>5. Tender not allowed to select price basis</td>
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<td>23. Tender must agree to pay return performance costs</td>
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<td>24. Tender must agree to pay return performance costs</td>
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</tbody>
</table>

**Legend:**
desirable exchange proposal, would be "21". Accordingly, exchanges having rating totals increasingly in excess of "21" would receive lower, less desirable rankings. If this approach is undertaken, the rankings would be as follows:

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Exchange Proposal</th>
<th>Sum of Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ESPSCA</td>
<td>23</td>
</tr>
<tr>
<td>2</td>
<td>Manitoba</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>Alberta</td>
<td>40</td>
</tr>
<tr>
<td>3</td>
<td>I.D.A.</td>
<td>41</td>
</tr>
<tr>
<td>4</td>
<td>Schrader</td>
<td>42</td>
</tr>
<tr>
<td>5</td>
<td>Johnson</td>
<td>43</td>
</tr>
<tr>
<td>6</td>
<td>Iowa Sheep Prod.</td>
<td>44</td>
</tr>
<tr>
<td>7</td>
<td>Henderson</td>
<td>47</td>
</tr>
<tr>
<td>8</td>
<td>Holder</td>
<td>48</td>
</tr>
<tr>
<td>9</td>
<td>MFA Slaughter Hog</td>
<td>49</td>
</tr>
<tr>
<td>10</td>
<td>MFA Feeder Pig</td>
<td>50</td>
</tr>
<tr>
<td>11</td>
<td>Maine Egg</td>
<td>51</td>
</tr>
<tr>
<td>12</td>
<td>Ontario</td>
<td>52</td>
</tr>
</tbody>
</table>

Another attempt to use the ratings in Figure 5.1 might rank the exchange proposals on the basis of the number of "1", "2", and "3", ratings earned by each proposal. Accordingly, the most desirable exchange will have the greatest number of "1" ratings and the fewest number of "2" and "3" ratings. Less desirable exchange proposals will have fewer "1" ratings and more "2" and "3" ratings. If this approach were used, the rank-
ings would be as follows:

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Exchange Proposal</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ESPSCA</td>
<td>19</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Manitoba</td>
<td>10</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Alberta</td>
<td>10</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>I.D.A.</td>
<td>7</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Schrader</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>Johnson</td>
<td>6</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>Iowa Sheep Prod.</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>Henderson</td>
<td>5</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>8</td>
<td>Holder</td>
<td>4</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>9</td>
<td>MFA Slaughter Hog</td>
<td>6</td>
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<td>13</td>
</tr>
<tr>
<td>10</td>
<td>MFA Feeder Pig</td>
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<tr>
<td>11</td>
<td>Maine Egg</td>
<td>5</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>12</td>
<td>Ontario</td>
<td>4</td>
<td>3</td>
<td>14</td>
</tr>
</tbody>
</table>

After reviewing the ratings derived under these two ranking approaches, two general observations can initially be made. The first observation is that rankings for the thirteen exchange proposals under the two approaches are identical. Some question may be raised about the correctness of this observation due to the apparent inconsistency in my seventh, eight, ninth, tenth, and eleventh place rankings under the second ranking approach. However, I believe these rankings can be justified by the following explanation. It was necessary to place the MFA slaughter hog telephone auction with six "1" ratings below Henderson's computerized slaughter hog exchange with four "1" ratings because the MFA slaughter hog auction has thirteen "3" ratings, whereas Henderson's and Holder's exchanges each have only ten "3" ratings. Similarly, Holder's exchange was ranked ahead of the MFA feeder pig telephone auction and Maine egg telephone auction, each with five
"1" ratings, because Holder's exchange earned three fewer "3" ratings than the MFA feeder pig auction and the Maine egg auction.

The second observation, based on the ranking of the thirteen exchange proposals, is that the four types of exchange proposals may be ranked for desirability as follows: first (most desirable): ESPSCA; second: teletype auctions; third: computerized exchanges; and fourth (least desirable): telephone auctions. More specifically, the ESPSCA, which is ranked in first place under both approaches, is clearly the most desirable type of electronic exchange. The teletype auctions, with the exception of the Ontario slaughter hog teletype auction, received the next highest desirability rankings. That is, the Manitoba and Alberta slaughter hog teletype auction were ranked in second place, the I.D.A. was ranked in third place, and Johnson's slaughter cattle teletype auction was ranked in fifth place. The computerized bid-offer matching exchanges generally received lower rankings than the teletype auctions. Specifically, Schrader's electronic egg exchange was ranked in fourth place, Henderson's computerized feeder calf exchange was ranked in seventh place, and Holder's computerized slaughter hog exchange was ranked in eighth place. And finally, the telephone auctions, which generally received the lowest rankings, were determined to be the least desirable type of electronic exchange. That is, the Iowa Sheep Producers' telephone auction was ranked in sixth place, the MFA slaughter hog telephone auction was ranked in ninth place, the MFA feeder pig telephone auction was ranked in tenth place, and the Maine egg auction was ranked in eleventh place.

The reason for the ESPSCA's superior overall rating under either
approach may be attributed to three main features of the exchange: 1) rules that eliminate the requirement of centralized cattle and bidder assembly; 2) the selected simultaneous progressive auction transaction system which makes possible interlot price comparisons; and 3) rules that permit multiple-price determination.

First, the ESPSCA's adoption of rules allowing cattle to be sold while still in the feedlot and optional in-feedlot grading eliminate the unnecessary costs associated with exchanges requiring centralized assembly of cattle. Accordingly, the "redundant transportation," "nonproductive facilities," "unnecessary handling," "uneven delivery of cattle at plants," and "feeders not allowed to refuse packer bids without incurring excessive costs" criteria were substantially satisfied. Although previous exchange proposals have utilized electronic bidding networks to eliminate the need for centralized bidder assembly, several of these exchanges have maintained rules requiring regionalized livestock assembly.

Second, the ESPSCA's utilization of the simultaneous progressive auction transaction system, which enables the disclosure of competing bids on each lot and thus interlot price comparisons before the exchange price for any lot is finally determined, has been attributable for the ESPSCA's substantial satisfaction of the "unwarranted price fluctuation," "persistent maintenance of interregional price differential," "competing bids not rapidly disclosed," and "not allowing all bidders to bid on every lot" criteria. These criteria are satisfied in part because this disclosure facilitates interlot price comparisons and thus formulation of bidding strategies.

Third, the modifications in the basic simultaneous progressive auction
transaction system rules allowing for multiple-price determination has made possible the use of market-determined quality price differential schedules and combination trading bases. Together, these features allow the ESPSCA to satisfy the "traders not allowed to select price basis" criterion.

The two "2" ratings received by the ESPSCA are for the "costly search for cattle" and "sophisticated trading rules" criteria. The ESPSCA's failure to substantially satisfy the "costly search for cattle" criterion is primarily due to the exchange rules that deny traders the option of utilizing a more expedient price determination system than the simultaneous progressive auction transaction system. The ESPSCA's failure to substantially satisfy the "sophisticated trading rules" criterion is mainly attributable to its utilization of complex electronic equipment. This sophisticated electronic hardware will likely require substantial bidder and consignor retraining in order for them to effectively use these devices. It should be noted, however, that none of the other electronic exchanges under consideration received a higher rating for either of these criteria.

Caution in the use of these overall ratings is advisable for at least two reasons. First, no attempt has been made to assign relative weights indicating the relative importance of satisfying the various criteria. Thus, these overall ratings give equal weight to factors which may be of lesser importance. Second, the use of only three gradations of ratings may be misleading. For example, exchange proposals which fail to satisfy a particular criterion are merely given a "3" rating. Accordingly, no attempt is made to distinguish between degrees of nonsatisfaction. That
is, the same "3" rating is given to exchanges which barely fail to satisfy a criterion and those which grossly fail to satisfy a criterion. This latter criticism might be partially remedied through the use of a rating system with more than three gradations. However, this remedial step was not taken in the present evaluation due to the imprecise measures of criterion satisfaction. If attempts are made in later research to empirically estimate these measures, a more accurate system of rating the degree of criterion satisfaction may then become feasible.

In examining the credibility of these ratings, one may further question why it is that my own proposal almost always received a superior rating as compared to its predecessor exchange proposals and whether I could objectively evaluate my own proposal. In Chapter III's initial development of the exchange criteria, I pledged my willingness to comply with Sosnick's principles for establishing market criteria. [26, p. 828] That is, I agreed to be specific, definite, explicit, realistic, discriminating, comprehensive, and stringent. [26, p. 828] However, in assessing the resultant market ratings one should perhaps consider the difficulty of fully complying with several of his own market criteria principles. [26, p. 841] For example, my list of criteria is quite likely not "comprehensive." The "comprehensive" principle requires that I anticipate and mention every market characteristic that I might regard as undesirable. My failure to cite one such criterion would cause users of this study to think that my proposed exchange is desirable, when it actually has characteristics which I regard as being serious deficiencies. [26, pp. 835-36] Furthermore, the users of this study should consider the likelihood that I have identified only cri-
teria which my ESPSCA proposal can satisfy.

In addition, it is likely that I have not been "stringent" in my establishment of the necessary conditions for criterion satisfaction. According to Sosnick, a market evaluator "should refuse to moderate his necessary conditions" in order to claim that a particular market is effectively competitive. [26, p. 839] However, in evaluating my own ESPSCA proposal relative to prior electronic exchanges it is likely that I am, and resultantly my evaluation is, biased in favor of my own proposal. In fact, if I were to precisely follow Sosnick's "explicit" principle and state that to be effectively competitive (i.e. socially desirable) an electronic exchange must satisfy each and every criterion, it is likely that none of the proposed exchanges is effectively competitive. That is, my use of the "2" rating, indicating that an exchange "satisfies a criterion to some extent", may be an indication in itself that I have moderated my necessary conditions for effective competition in order to claim that my proposed exchange is effectively competitive. Furthermore, my use of the inconclusive "1" rating, indicating that an exchange "substantially satisfies the criterion," indicates a less than "stringent" requirement that a market "satisfy" a market criterion.
VI. SUMMARY AND CONCLUSION

The purpose of this chapter is fivefold: 1) to summarize the development and evaluation of the ESPSCA; 2) to enumerate the advantages of the proposed ESPSCA over previous electronic exchange proposals; 3) to identify and acknowledge the weaknesses in the ESPSCA; 4) to suggest practical and theoretical topics regarding the ESPSCA which warrant further investigation; and 5) to consider the future of electronic commodity price determination.

A. Summary of the ESPSCA Development and Evaluation

In Chapter I, the following two objectives for this study were formulated:

1. To design an electronic slaughter cattle exchange for marketing cattle fed in Iowa which eliminates the deficiencies existent in previous electronic exchange proposals; and
2. To develop a method for conducting a comparative evaluation of the proposed exchange relative to previous electronic exchange proposals.

In Chapter II, three types of electronic exchanges which have previously been proposed, were reviewed. The purpose of this review was to identify the imperfections in these proposals. Once identified, these deficiencies were to provide guidance in the design of an improved exchange.

In Chapter III, twenty flaws, each of which inhibits the attainment of effective competition by electronic livestock marketing systems, were identified. These flaws were used in Chapter V to develop a set of criteria for conducting a comparative evaluation of the ESPSCA relative to the three previous types of electronic exchange proposals.

In Chapter IV, the ESPSCA was progressively developed. The develop-
ment commenced with the selection of the simultaneous progressive auction transaction system. Thereafter, fundamental rules of the simultaneous progressive auction transaction system were modified to allow for multiple-price determination. This rule modification made combination trading bases and market-determined quality price differential schedules possible. Subsequently, the simultaneous progressive auction transaction system was used as the basis of a Nonelectronic Simultaneous Progressive Slaughter Cattle Auction (NESPSCA) which utilizes a chalk bidding board. After noting the deficiencies in the NESPSCA and the consequential need to conduct the auction electronically, a search was begun for electronic components to build an electronic marketing system. The search resulted in the selection of an electronic marketing system which utilizes cathode-ray tube display stations as remote bidding terminals, an electronic digital computer as the central processing unit, and touch-tone telephones as remote consignment terminals. After selection of the electronic components, a series of computerized subroutines were proposed which would enable the bidders to specify and view from one to eight lot bid arrays on their cathode-ray tube screens. These subroutines would also allow packers to enter bids from their remote bidding stations through the use of their fiber-optic light pens, alphameric keyboards, and programmed-function keyboards.

In Chapter V, the twenty potential flaws in electronic marketing systems were used to develop twenty criteria to be used in the comparative evaluation of the three previously proposed types of electronic exchanges and the ESPSCA. The overall results of this evaluation show that the ESPSCA is generally superior to the telephone, teletype, and computerized exchange proposals. The primary features attributing to the ESPSCA's favor-
able rating are: 1) the ESPSCA's rules permitting multiple-price determination; 2) the simultaneous progressive auction transaction system which allows disclosure of competing bids prior to the time the exchange price on any lot is determined; and 3) the ESPSCA rules which permit cattle to be sold while still in the producer's feedlot.

B. Advantages of the Proposed Electronic Simultaneous Progressive Slaughter Cattle Auction

The primary advantages of the proposed ESPSCA over prior electronic exchange proposals are described below.

A number of the ESPSCA advantages result from the auction rules which permit cattle to be sold while still in the feedlot. For example, sale of cattle while still in the feedlot eliminates the cost of maintaining facilities for centralized cattle assembly. In addition, the sale of cattle while still in the feedlot eliminates unproductive cross-hauling and lessens a producer's cost of refusing an unacceptably low packer bid. Furthermore, the fact that cattle may be sold while still in the feedlot allows packers to plan a daily cattle delivery and kill schedule which will best utilize their manpower and plant resources.

In addition, three ESPSCA advantages are attributable to the selection of the simultaneous progressive auction transaction system. First, because the simultaneous progressive auction transaction system allows bids to be received concurrently on a number of lots, interlot price comparisons before the exchange price on any lot is finally determined, is possible. Second, due to the interlot price comparison capability the simultaneous progressive auction transaction system reduces the amount of lot-to-lot random price
fluctuation. This random price fluctuation had been characteristic of previous electronic exchange proposals utilizing the successive regressive auction transaction system. Third, as a further result of the interlot price comparison, bidding strategies under the ESPSCA are expected to be more easily formulated.

A number of other rule modifications have also yielded advantageous ESPSCA features. For example, the modification of the simultaneous progressive auction transaction system to permit multiple price determination has yielded market-determined quality price differential schedules, as well as provided producers with the option of having their cattle priced under several different trading bases. In addition, the rule modification providing for the Name Disclosure Option allows producers to differentiate their cattle on the basis of producer reputation. This option encourages the production of quality cattle and acts as a partial substitute for presale visual cattle inspection.

C. Weaknesses of the Proposed Electronic Simultaneous Progressive Slaughter Cattle Auction

While the advantages offered by the ESPSCA appear to be substantial, this proposed electronic cattle exchange is not without its limitations. A number of these weaknesses are described below.

First, it must be recognized that the anticipated financial cost of procuring and programming the needed electronic computer components will be extremely high. Without further empirical proof of the economic gain to be attained by adoption of the ESPSCA, this high cost of electronic components may make implementation of the auction an unrealistic proposition.
A second problem which is related to the start-up cost limitation involves the recruitment of packer and producer participation in order to obtain a sufficient trading volume.

A third weakness which has been present in previous electronic exchanges, as well as in the ESPSCA, is the "free-rider" problem. The essence of this problem is that if compulsory utilization of an electronic exchange is not required, producers and packers will market cattle directly and use an average of prices determined by the electronic exchange, without actually consigning the cattle on the auction and paying an auction fee. To date, the only proposed solution for the free-rider problem has been compulsory marketing through the electronic auction, or a required per head assessment for all cattle a producer markets, regardless of whether or not they were sold through the electronic exchange. Naturally, packers and producers in the United States will be reluctant to adopt a compulsory marketing system. Unfortunately, no better solution for the free-rider problem has been presented in this ESPSCA proposal.

Another weakness of this ESPSCA proposal arises from what may be considered to be sophisticated trading rules. Sophisticated trading rules, along with the drastic change in cattle marketing and price determination inherent in the use of the ESPSCA, may require extensive training of market participants. Not only must the participants be trained in the operation of the electronic hardware, but they must also learn how to make intelligent ESPSCA trading decisions. Furthermore, due to the utilization of the simultaneous progressive auction transaction system, participants in the ESPSCA will be forced into reformulating their bidding strategies.
Considerable packer objection may be aimed at the uncertainty associated with ESPSCA lot withdrawal procedures. Pursuant to these proposed procedures a packer will not know the number of cattle he has purchased until after an auction session's bidding has ceased. Packers may argue that this procurement uncertainty may make it difficult for them to schedule a uniform daily kill. However, the end result of this uncertainty may be to encourage forward pricing of cattle for future delivery.

A final weakness in the proposed ESPSCA arises from my use of "at-feedlot" and "at-assembly yard" prices. Because all bids viewed by bidders will be on an at-feedlot or at-assembly yard basis, interlot price comparison will be hampered. This hinderance arises from the fact that each bidder will have to subtract his own transportation cost estimate from the bid prices for each lot before making "net price" or "delivered price" comparisons. This price comparison limitation could be reduced if all bids were on a delivered basis. However, the use of delivered basis bids would require a complex transportation cost adjustment procedure after bidding has ceased in order to determine whether withdrawal was necessary.

D. Suggested Topics for Additional Research

To assist the reader in utilizing this study, I shall now suggest several topics worthy of further investigation. These topics fall roughly into two categories. The first category is comprised of practical topics and operational problems which producers and packers should investigate before attempting to actually implement an ESPSCA (Subsection 1). The second category is comprised of theoretical topics involving electronic simultaneous progressive commodity auctions which merit further research and empirical
analysis (Subsection 2).

1. Practical research topics

Before manpower and capital are invested in an attempt to actually establish and operate an operational ESPSCA, several practical topics merit further investigation. These topics are briefly described below.

First, an investigation into the exact cost of purchasing or leasing the electronic hardware components of the ESPSCA should be conducted. Although in designing the ESPSCA I realized that this cost would be substantial and that it perhaps is the primary disadvantage of my proposal, I have made no effort to estimate this cost in my study. It was decided to omit the electronic hardware cost estimates because within a few years after this thesis is written the estimates would undoubtedly become outdated and unrealistic. In addition, the cost of procuring electronic hardware would be substantially reduced if the host market agency selected already has its own electronic computer.

Second, consideration might be given to comparing the cost of establishing a Nonelectronic Simultaneous Progressive Slaughter Cattle Auction, which utilizes a chalk bidding board, with the cost of the ESPSCA. In addition, it may be desirable to determine the annual volume of trading at which implementation of the electronic auction system is economically justified.

Third, prudent promoters of an ESPSCA might be well advised to survey the cattle industry in an attempt to determine what portion of the producers and packers would be willing to utilize the ESPSCA, and the annual trading volume which could be expected. The results of this statistical survey
should indicate whether an attempt to establish an ESPSCA would likely be successful.

Fourth, much promoter consideration should be given to the practical problems of establishing an ESPSCA. These problems include the following: 1) selection of an organization to operate the ESPSCA; 2) obtaining the necessary financial backing to undertake the establishment of the ESPSCA; 3) promotion of the ESPSCA in order to get initial packer and producer support for the ESPSCA; 4) legal issues regarding the drafting of producer marketing agreements, the law of auctions, incorporation of the market agency, and antitrust law compliance; and 5) determination of the amount and source of fees for usage of the ESPSCA.

Fifth, before selecting electronic hardware components to implement the ESPSCA, further investigation of the exact capabilities of the available components will be necessary. Because I have proposed the ESPSCA design from the standpoint of an economist rather than a computer scientist, this examination may require consultation with a systems analyst.

And finally, prior to implementation of the ESPSCA it will be necessary to employ a computer programmer to develop programs and subroutines necessary for conduction of the ESPSCA. Conceivably, the description of programmed-function subroutines in Chapter IV would provide guidelines for the programmer as to purpose and results desired.

2. Theoretical research topics

From a theoretical standpoint several topics regarding the concept of simultaneous progressive commodity auctions merit further research.

First, with regard to the comparative evaluation of electronic ex-
change proposals, it may be possible to undertake a quantitative comparison which attempts to empirically estimate the measures of criterion satisfaction.

Second, it may be possible to quantitatively estimate the actual economic gain which would arise from implementation of an ESPSCA. This estimate would desirably take into consideration the cost savings from the reduction of cross-hauling inherent in centralized cattle assembly, the value of the increased opportunity for competitive bidding on cattle lots, the packer savings in cattle procurement costs, the value of improved pricing accuracy arising from market-determined quality price differential schedules, the cost savings from enabling a planned delivery of cattle at slaughtering plants, and the increased exchange efficiency, more equitable division of gains, and the reduction in interlot price fluctuation arising from utilization of the simultaneous progressive auction transaction system.

Third, further consideration should be given to resolving the free-rider problem by methods other than compulsory marketing or compulsory payment of marketing fees.

Fourth, an attempt should be made to rank or assign a priority or relative weight to the twenty exchange criteria developed in Chapter V. By assigning relative weights to these criteria, the overall evaluation of each electronic exchange proposal will become more meaningful.

Fifth, one might explore the feasibility of using the ESPSCA systems design for pricing other agricultural commodities, or the development of an electronic multi-commodity exchange.
In addition, further refinement in the design of the proposed ESPSCA may be undertaken. For example, it may be possible to replace the human operator at each bidding station with the packer's computer. That is, it may be possible for each packer to program his computer to enter the desired bids on the simultaneous auction. Accordingly, a packer could give his computer the variables for specific exchange terms such as the allowable high bid on each lot component, the desired price differential between lot components, and the volume of cattle needed during each delivery interval. Thereafter, the packer's computer would utilize these parameters as guidelines in entering bids on the auction. This advancement would not only accelerate the speed of the auction and increase the lot trading capacity of the ESPSCA session, but it would also readily facilitate interlot price comparisons.

E. What Is the Future of Electronic Commodity Price Determination?

I began this thesis by citing Wilcox's conclusion [31, p. 115] that present market structure and institution developments represent only one point on the continuum of marketing change, and that technological innovations would provide the impetus for further change during the remainder of the Twentieth Century. After a thorough investigation of recent electronic exchange proposals and my own examination of present electronic capabilities, I concur in Wilcox's opinion that further change in marketing institutions is inevitable. My conclusion is premised on the following beliefs. First, I think that the energy conscious society of the mid-1970's and the rising cost of transportation fuels will force the livestock and
meat industry into considering marketing systems which eliminate unproductive cross-hauling. Second, I believe that today's livestock feeders are better informed and educated as to their marketing alternatives and the weaknesses in the present marketing systems. And third, I think that several successful efforts have recently been made to organize producers and packers into groups dedicated to further industrywide advancements. Several of these organizations may have the capability to promote and/or operate an electronic livestock marketing system.

While I do not necessarily think that the future trend in cattle marketing institutions will be towards implementation of the ESPSCA, I do believe that there are substantial advantages which favor the future of computerized electronic exchanges. Furthermore, I realize that the ESPSCA is just one electronic exchange design, and that other improved versions are likely to follow. Nevertheless, I believe that the comparative evaluation and evaluative criteria utilized in this thesis present an analytical tool which can contribute significantly to the planning and design of these future electronic exchanges.
VII. SELECTED BIBLIOGRAPHY


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