IDENTIFYING AND PREDICTING PERFORMANCE FOR STOCKER AND FEEDER CATTLE

By

MARY KATHERINE HAWK

Bachelor of Science in Agriculture

The University of Tennessee

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STOCKER AND FEEDER CATTLE

Thesis Approved:

Clement E. Ward
Thesis Adviser

James N. Trapp

Francis M. Epplin

Norman N. Durham
Dean of the Graduate College

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CHAPTER I

INTRODUCTION

Beef cattle producers in Oklahoma and throughout the U.S. have been experiencing financial stress in recent years. These financial difficulties have occurred in spite of advanced technology and increased efficiency in the production process. Thus, producers must look beyond production practices to identify the source of their troubles and to seek solutions. Alleged causes of industry adversities include a shift in demand for beef (due to stiff competition from poultry, diet-health concerns, lifestyle changes, and other demographic adjustments), declining land values, high real interest rates, volatile cattle prices, the Dairy Buyout, as well as various deficiencies in marketing expertise applied to cattle and beef.

In general, cattle producers have placed more emphasis on production rather than on marketing of their agricultural products. This production orientation results in a propensity for cattlemen to consider only the activities at one stage in production, concentrating on technical efficiency and cost reduction at that stage. However, the U.S. beef industry is a multistaged production-marketing system. The product (cattle, then beef) most often passes through a series of stages before reaching the ultimate consumer. The output of one stage becomes the input of the subsequent stage. Therefore, actions taken at each stage affect one or more other stages in the beef system.

The Problem

Managers at each stage of activity in the beef marketing system employ performance standards they believe will increase the value of their output and/or reduce their cost of production. That is, they describe cattle performance according to anatomical, physiological, and genetic traits that increase efficiency of resource use and/or increase product value in the marketplace. When selecting or purchasing cattle, managers choose animals most likely to meet their performance criteria during production.

However, conditions of exchange and production suggest that performance criteria emphasized at one stage may differ from and, in some cases, conflict with those of another. For instance, official grades and informal standards used to classify cattle in the marketplace may or may not define potential for performance as prescribed by the buyer. Therefore, output of the previous stage may or may not be valued according to the next stage's criteria for performance potential. In addition, the same classifications are not utilized at all interfaces, where stages meet. For instance, feeder cattle may be assigned muscling grades while fed cattle receive yield and/or quality grades or none at all. Production conditions vary from stage to stage as well, due to changes in animals' development, e. g. location on the growth curve. Thus use of different measures and criteria from stage to stage is sometimes necessary.

Producer groups and individual firms in the beef industry perceive a need for predictable performance. In fact, the survey conducted for this study (Chapter III) revealed that almost all producers in cow-calf, stocker, and feedlot stages identified "inability to predict performance when buying stocker and feeder cattle" as their greatest purchasing concern, among a list of five possible purchasing concerns. Concerns regarding changes in demand for beef, have resulted in industry participants making a greater effort to identify and satisfy consumers' tastes and preferences. As a result, the beef industry is entering an age of "specification beef." Specifications are being drawn up by packers describing cattle producing the most desirable carcasses and retail cuts to meet their requirements for handling, processing, packaging, and portion control processing in response to consumer demand. Cattle and carcasses meeting these standards will receive the highest price with prices for others discounted, resulting in less "pricing on the average."

Producers could potentially combine this new trend with additional information to benefit themselves as well as other stages. First of all, by learning to utilize performance measures used in the previous stage(s) and at the point of exchange, managers might better predict performance in their own stage of production, thus reducing risk and uncertainty. By gauging this expected output to the specifications of the next stage, managers could more accurately predict output price, further controlling their risk. However, this opportunity depends upon recognizing what information from the previous stage(s) is valuable, and then acquiring or recording that information. Also, usefulness of information is partially dependent on how truthfully and accurately it is recorded and reported. In addition, producers could assist those in subsequent levels by making available performance information about animals being purchased.

Understanding performance criteria and utilizing information in the cattle marketing system could lead to reduced production risk and uncertainty as well as greater marketing efficiency, benefitting all stages of the beef subsector--from cow/calf producer to the ultimate supermarket consumer. Therefore, research is needed to identify the performance criteria used by producers at each stage of activity in the beef subsector. Also, determination of relationships among performance criteria within and between stages to identify any conflicts and inconsistencies is important. Such research would indicate what information could be used by producers to better predict and describe performance in their cattle operations.

Hypotheses

The two major hypotheses of this study are:

1. Inconsistencies exist among performance criteria used by managers at various stages of the beef subsector.
2. Use of performance measures from one stage of the beef marketing system could improve performance prediction for subsequent stages.

Objectives

The overall objective of this study is to determine if and how performance criteria could be employed by beef producers to predict performance and thus, decrease risk and uncertainty and improve market coordination. More specifically, the objectives are:

1. To identify performance criteria used by producers at each stage of the beef subsector, from cow-calf through feedlot;
2. To determine relative importance of each of these criteria;
3. To identify inconsistencies as well as similarities among performance criteria used by the cow-calf, stocker, and feeder stages of the beef industry; and
4. To identify reliable information, or performance measures, which will aid in predicting performance in subsequent stages.

Procedure

A combination of primary and previously recorded data was employed to achieve the above objectives. First of all, Oklahoma beef producers were surveyed to gather information necessary to achieve the first three objectives. The Oklahoma Cattlemen's Association (OCA) and Oklahoma State University's (OSU) Agricultural Economics Department cooperated to send a mail survey to 3000 cattle-producing members of the OCA. The survey included not only sections pertaining to this study but also questions submitted by the OCA. The OCA provided the mailing list, while OSU compiled and analyzed response data. The sample afforded by this method is not random but is larger than would have been otherwise possible with available resources.

For the fourth objective, secondary sources provided information on cattle performance of individual animals. Two western Oklahoma ranches provided birth-to-carcass data on three groups of individual beef animals. Plus, the Oklahoma Steer Feedout, conducted by the OSU Cooperative Extension Service, furnished individual feedlot and carcass performance data.

These data provided the opportunity to relate survey responses to actual performance results, without the cost of collecting primary data. Therefore, relationships among performance criteria suggested by survey responses were "tested" on actual performance data. Data samples were small but provided a useful base to begin comparing producer survey responses with actual performance records.

CHAPTER II

COORDINATION, INFORMATION, AND THE BEEF SUBSECTOR

The Systems Concept

The agricultural economy is composed of commodity subsectors, each of which produces, processes, and distributes an agricultural commodity or related set of commodities. Though these activities may be conducted by many firms as the product flows through a channel of distinct operational stages, these activities are interdependent. That is, decisions made at one stage of activity will be influenced by and have an effect on actions in one or more subsequent stages. Hence, the concept of a marketing "system" is applied to these subsectors.

The Systems Approach

The system concept is built upon the interdependence of component parts. Ackoff (1974, p. 13) defines a system as "a set of two or more interrelated elements of any kind,...not an ultimate indivisible element but a whole that can be divided into parts." "Elements" of a system can be studied independently but cannot be operated independently of one another. Therefore, performance of the system depends not only on that of elements of the system but also on coordination and communication between elements. Thus, a "systems approach" would encompass the components of a system and their relationships in analysis.

According to Rabow (1969, p. 2), "In the systems approach, the basic requirements imposed on the system are determined in advance, and each component must operate in such a way as to best meet the system requirements." The system is a landscape with the elements orchestrated to create the prescribed "view" rather than for individual merit.

In Ackoff's (1974, p. 14-15) systems approach, "a problem is not solved by taking it apart but by viewing it as a part of a larger problem." Overall system performance "depends critically on how well the parts fit and work together, not merely on how well each performs when considered independently."

Schruben (1968, p. 1455-6) presents a different perspective to the systems approach. Rather than presetting standards the system must maintain, he sees the systems approach providing "specific information relating the effect of alternate solutions of one problem to the overall efficiency of the system of which it is a part and to other subproblems in the same system."

Most importantly, underlying each of these versions of the systems approach is the value placed upon the system's overall operation and outcome rather than that of each component.

The Systems Approach and Subsector Analysis

Over the past three decades, certain agricultural marketing researchers have advocated applying the systems approach to agricultural subsector analysis. In the 1950's Kohls (1956, p. 71) wrote:

> If the problem is one of firm or intrafirm efficiency, the formulation of the ends in measurable terms may be relatively simple. If the problem is one concerning efficiencies of the whole marketing

> system, the framework of the ends must be worked through giving explicit consideration to all of the value judgements involved.

Kohls (1956, p. 72) also asserted that "some must shoulder the responsibility of evaluating and synthesizing these parts (of the marketing system) to discover their significance at the higher levels of aggregation."

Later, Shaffer (1968, p. 1443) addressed the changing orientation of marketing research, calling for "the analysis of problems in the context of the broader system, an analysis which takes into account feedback, sequences, and externalities." Schruben (1968, p. 1456) on the same subject, suggested, "Often the first step is to describe the interrelationships involved in qualitative terms" before proceeding to quantitative analysis.

As Godwin and Jones (1971, p. 813) explored implications of the emerging food and fiber system, they concluded:

> The analytical requirement emerging is one that can deal effectively with problems involving multifirm and multifunctional segments of the system. This is in sharp contrast to conventional analytical framework of the individual firm and much of the marketing and price analysis that has been conducted.

Purcell (1973, p. 68) applied the systems approach to portions of the beef subsector in vertical coordination research at Oklahoma State University finding:

> conflicts and inconsistencies in the most basic interstage or interlevel relationships. ...Attention on these barriers to interlevel coordination...is what appears to be needed. Meeting these needs means 'systems research' or, at a minimum, an orientation that acknowledges existence and importance of interlevel behavioral relationships as the primary determinant of the realized degree of coordination along the vertical dimension of any marketing system.

In spite of these recommendations, agricultural marketing analyses seldom encompass the entire system, or even more than one stage of activity in a subsector. Making improvements in only one stage in no way guarantees other stages or the system as a whole will gain, or even maintain par performance. However, Purcell and his students made relevant use of systems analysis for their investigations of vertical coordination, communication, and goal consistency in the beef subsector (Nelson, 1976; Purcell and Dunn, 1972; Rathwell and Purcell, 1972).

The Vertical System

As previously stated, an agricultural subsector produces, processes, and distributes an agricultural commodity or related set of commodities. In order to accomplish these tasks, the subsector is composed of many interdependent firms performing the operations necessary to produce ultimate consumer products. A description of the organization and structure of such a subsector may best begin with its basic economic activity, production.

Composition of a Vertical System (Mighell and Jones, 1963)

"Production" is the creation of time, place, or form utilities, which contribute to the utility embodied in ultimate consumer goods and services. The organizational unit conducting these activities is the firm. Mighell and Jones (1963, p. 6) define an economic firm as "any separate economic organization that has as its purpose the production of economic goods or services." A firm performs one or more tasks fitting into a chronological, or technically successive, series of activities which constitute the complete production process. Each task may be thought of as an economic stage, defined as "any operating process capable of producing a salable product or service under appropriate circumstances" (Mighell and Jones, 1963, p. 7). A "stage" may also encompass a series of minor stages which compose a logical, convenient grouping, especially if traditionally accomplished by the same firm. The chronological chain of these stages is considered a "vertical" continuum, executing production from raw materials to finished product.

System Effectiveness

Effectiveness of such a vertical system depends on the efficiency with which the system: 1) performs activities at each stage in the vertical continuum; and 2) coordinates production activities to meet consumer demand (Purcell, 1979). The first case is measured in terms of technical efficiency, basically output produced per input of resources, measured in dollars or other units. Research and development devoted to improving technical efficiency have resulted in bountiful technological advances available to managers of stages throughout agricultural subsectors.

Vertical Coordination. The price system is charged with the task of coordinating stages of activity, the second basis of efficiency (above). "The ways in which the vertical stages of production are controlled and directed" are known as "vertical coordination" (Mighell and Jones, 1963, p. 10). How well the system is vertically coordinated from producer to consumer depends on the extent of activity coordination along the interfaces between adjacent stages (Purcell, 1963).

With each operational stage managed by a different firm or group of firms, the market is the coordinator of product flow between stages by means of price discovery (further explained below), such as negotiation, centralized auction, or contracting. However, if the price system is not operating efficiently enough, market participants may find an economic incentive to vertically integrate. That is, a single firm may conduct the activities of successive stages in the chain and thus be responsible for coordination of activities. The single firm would administer the transfer of products from stage to stage internally.

Barriers to Coordination (Purcell, 1979). Several barriers may stand in the way of efficient market exchange. Goals of managers at different stages of activity may conflict with each other. Therefore, production completed at one stage would impede rather than promote the desired production process of one or more subsequent stages. Also, if managers of production stages are not aware of or misunderstand each others' needs, techniques, procedures and problems, then they are unlikely to produce the goods or services desired by consumers further along in the system.

Managers unknowingly erect these barriers when they fail to view their firm and its production process as a part of the whole system. This prevents them from considering the impact other stages have on their own operation and vice versa. In addition, the price mechanism may not be communicating demands via discounts and premiums, or price signals. Therefore, to foster coordination, system participants should come to understand one anothers' marketing and production circumstances. Also, adjustments in exchange conditions may be needed to improve the ability of buyers to compensate sellers for products in accordance with their value to subsequent stages, thus avoiding "buying on the average."

The Role of Information

Increased availability and proper use of pertinant product information is closely related to reduction of barriers to coordination and their underlying causes. Therefore, information plays an important role in system effectiveness.

Information and Price Discovery

Price discovery is the process by which a buyer and seller agree upon a price for a given product at a given time and place (Purcell, 1979). Price discovery is a specific event while price "determination" is the general equilibrium level reached by the interaction of supply and demand forces. Price determination plays a role in price discovery, to the extent participants are aware of the broad supply and demand situation and apply this knowledge to negotiations. Price discovery is not unlike price forecasting (Thomsen and Foote, 1952). Buyers and sellers formulate expectations of product prices they will find in the marketplace. This process occurs in two distinct phases: 1) evaluating conditions of demand and supply to determine the general level of prices which will result from these conditions and around which prices will fluctuate for particular lots of the commodity in different locations, of different qualities, and in different transactions; 2) determining the value of a specific lot of the commodity being exchanged relative to the general market level (Thomsen and Foote, 1952, p. 120).

Not surprisingly, this is an inexact process, with the outcome resting on relative information held by participants. Figure 1 shows the distribution of prices about the unknown equilibrium price (Purcell, 1979). Those prices most distant from the equilibrium seem repeatedly influenced by the buyer's or seller's lack of information or an imbalance of information or power held by

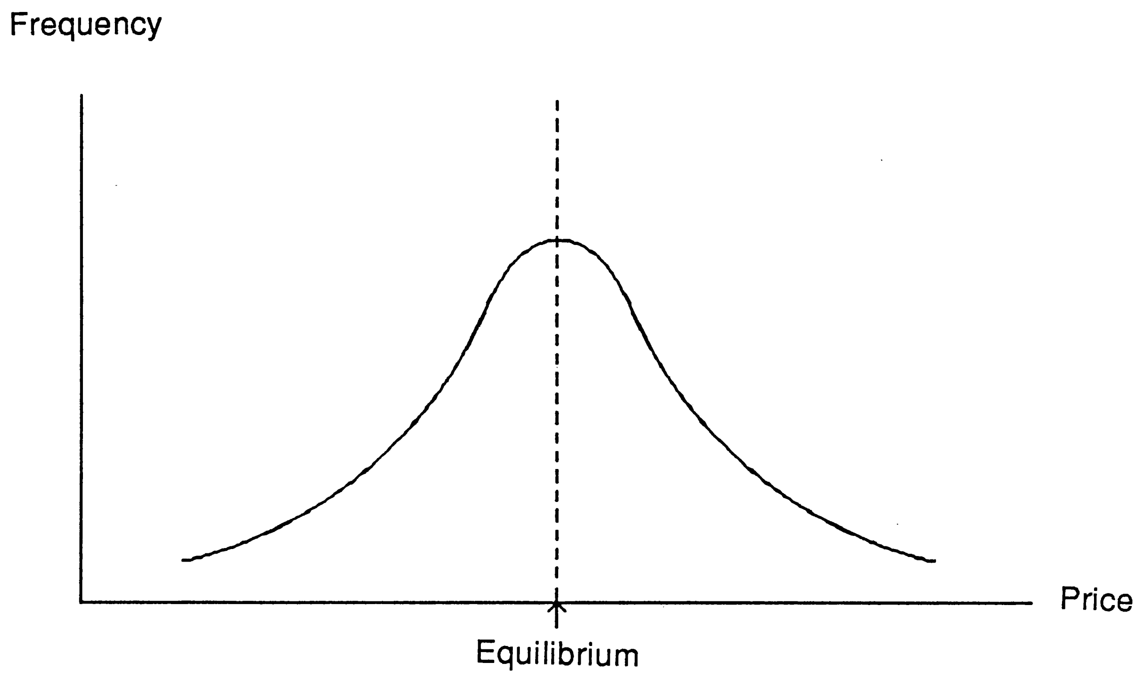


Figure 1. Frequency Distribution of Prices Around the Equilibrium (True) Price (Purcell, 1979, p. 109)

either buyer or seller. Therefore, information relevant to phases of price discovery is of importance to market participants.

As buyer and seller enter the price discovery process, each formulates a price expectation based on perceptions of the current situation and on past experience. In this first phase, buyer and seller may utilize commodity supply reports, publicly or privately reported market news, information from other participants, or recent historical transaction information. In the second phase, participants rely upon information on the particular lot of product being exchanged. The price discovered is dependent to some extent upon the buyer's anticipation of this lot's future value, i.e., its performance in the next stage(s). Again, information may be made available to improve this forecast. Pertinent facts might include grades, performance measures obtained in previous stages, past management practices, etc.

Information and "True" Price

Thomsen and Foote (1952, p. 81) write:

> if actual supply and demand conditions were fully known to all buyers and sellers at all times, if the judgement of individual buyers and sellers in translating these conditions into bids and offers were the same, and if competition among traders were always perfect, the price existing in the market at any time would be the "true" supply-and-demand price. ...But such information, judgements, and competition are never perfect, and as a result, market prices fluctuate back and forth around the true supply-and-demand...price.

Tomek (1980, p. 435) addresses this situation by defining information "statistically as the reciprocal of the variance. If...the average of transactions is an estimate of the true equilibrium price, then the variance of the mean of transactions prices decreases as the number of transactions increases."

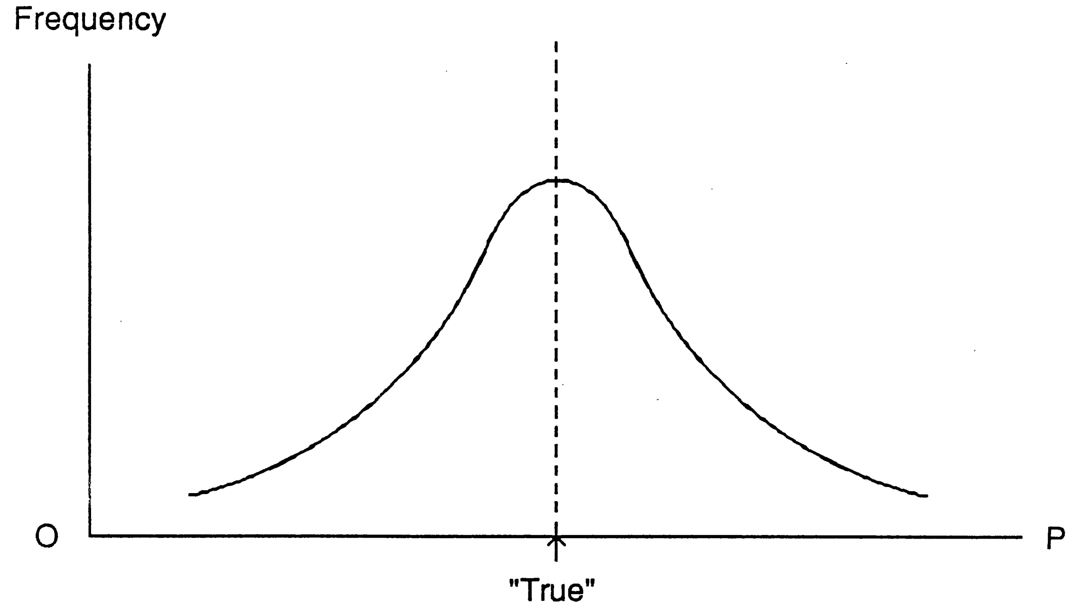
Assume an increase in transactions means an increase in publicly reported information. Thus with more information, mean price variance is reduced, meaning discovered prices are converging toward the "true" price. Figure 2 illustrates this concept for a "thin" versus an "active" market. A "thin" market, having fewer transactions, results in less available information and larger variance of transaction prices. Conversely, more information, which becomes available in "active" markets, reduces variance around the mean price.

Stigler (1961, p. 214) puts it this way, "Price dispersion is a manifestation--and indeed, it is the measure--of ignorance in the market." For example, Purcell (1973, p. 68) found that "lack of information on important value-related product attributes can lead to inconsistencies between negotiated price and 'true product value'."

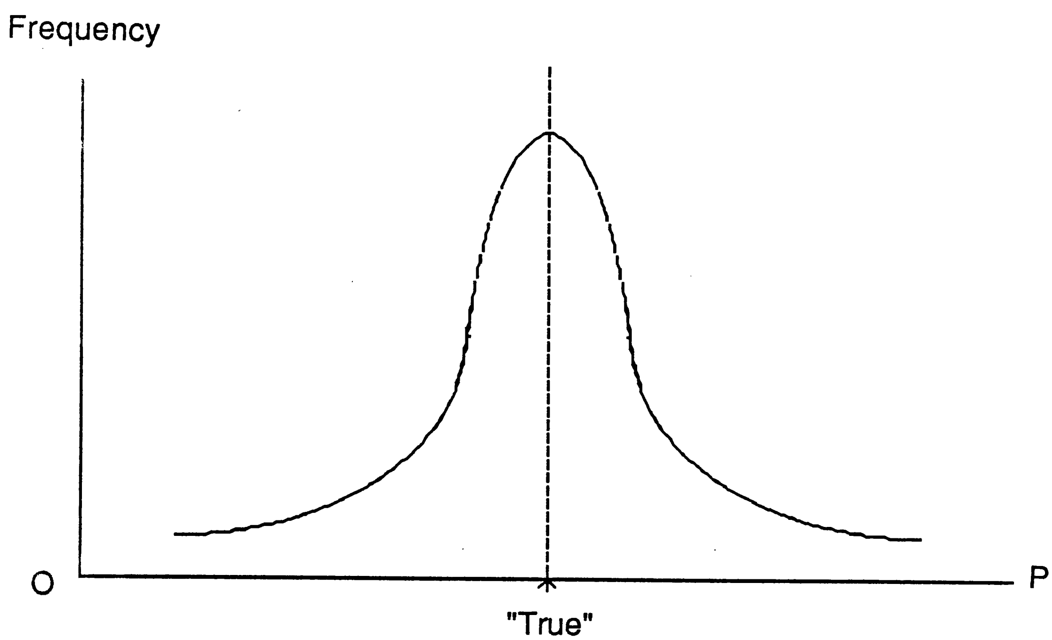
The greater the quantity of pertinant information in use, the more accurately the discovered price reflects the "true" price of the commodity. This "true" price is the value of the product to subsequent stages. So, if product demand of subsequent stages can be more accurately communicated through price signals with more available information, then information becomes an integral part of vertical coordination. Also, information exchange should allow participants at each stage to become more familiar and understanding of each others' situations.

<u>Information and Risk</u>

According to Mighell and Jones (1963, p.7), "The essential entrepreneurial function performed by the firm as a separate entity is the controlling or decision-making function, (and)...for every decision there is a risk."



Thin Market
(Less Information)



Active Market
(More Information)

Figure 2. Frequency Distribution of Prices at Different Levels of Information

Chavas and Pope (1984, p. 707) found that, "on the average, better information tends to improve the decision-making process and make the decision maker better off."

Within each operational stage, the decision-maker faces the basic profit equation:

$$\text{Profit} = \text{Revenue} - \text{Costs}. \tag{1}$$

"Costs" include the input product purchased from the previous stage plus the expenses of production in the current stage. Revenue, of course, is the proceeds from sale of the product to the next stage of activity. In any business firm, each of these financial exchanges carries a risk for both buyer and seller.

When the input product is purchased, the buyer must go through the price discovery process described above. A buyer must estimate what the demand will be for the product when sold to the subsequent stage as well as project costs for the buyer's production process.

These production costs are contingent upon efficiency of the product during processing. Thus, the buyer's degree of risk in valuing input purchases is partially dependent upon the buyer's ability to predict the product's "performance" during this stage. ("Performance" refers to efficiency of resource use and the value added for subsequent stages.) This ability to predict is dependent upon availability of information pertaining to the product being purchased and upon the producer's knowledge of relationships between that information and later performance. If the seller provides reliable information on product attributes, then the buyer should be able to better predict production costs and revenue and thus have a more accurate expectation of the profit equation and breakeven point.

When the production process in this stage is completed, the product continues its "flow" through the subsector, moving on to the next stage for further production, or "value-adding." Once again, the product must undergo price discovery at this new interface. The current owner faces another price risk when realizing returns for this stage of the production/marketing channel. However, ability to predict performance should pay off here. The better one's prediction, the more accurate one's price expectations. The price upon which the production plan was built should be closer to the price received than it would have been otherwise. Thus, a producer's management capability can be improved.

The Beef Subsector as a System

The Beef Marketing System.

The beef subsector is one of the more complex agricultural subsectors, with many participants and stages of activity. For example, the course of a T-bone steak or a hamburger might be traced generally as follows (Figure 3). The product begins as a calf in a cow-calf operation. Once weaned, it is pastured or fed in a stocker or backgrounding operation then finished on grain, probably in a feedlot. The finished animal is slaughtered and its carcass "broken" into wholesale cuts or retail products by a packer and/or processor. Finally, retail beef cuts come to rest in the retailer's meat case before being selected by the ultimate consumer.

Of course, many variations are made on this route, with the product possibly being handled or managed by livestock brokers, order buyers, auction markets, wholesalers, restaurants or institutions. Also, more than one stage of activity may be managed and/or owned by the same entity (i.e., vertically integrated).

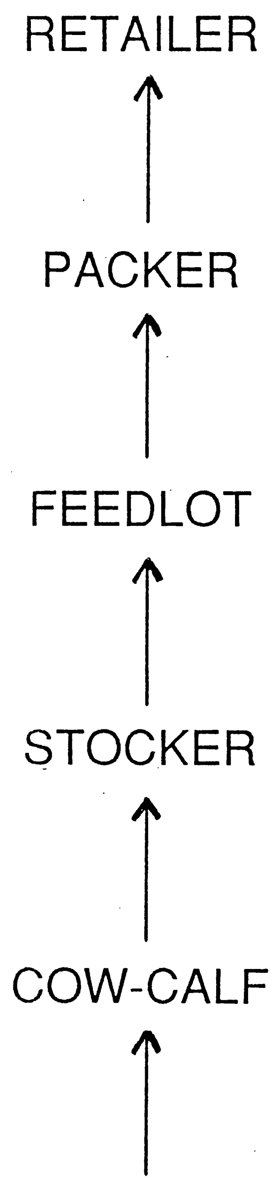


Figure 3. Basic Vertical Organization of the Beef Subsector

The concepts of vertical coordination and use of information, discussed above, are applicable to the beef subsector. For example, one interface in the beef subsector would be the transfer of feeder cattle (approximately 400-600 pounds) from a stocker operator to a feedlot manager for the animals to be finished out on grain. At this interface, coordination of these two stages occurs through price discovery. A value is placed on the product as it flows from one stage to the next. Also most communication between stages occurs at this time, such as information about the animals or needs of the feeder.

Interstage Price Discovery

In the beef subsector, price discovery occurs either in an organized central market, such as an auction or terminal market, or in individual, decentralized negotiations. Take, for instance, the negotiations between a stocker operator and a feeder for a set of feeder cattle. Each has some knowledge of recent feeder cattle transactions, though the information comes from various sources: recent market experience, other beef operators, or private and/or public market news. The stocker operator may also take into account cattle supply reports and slaughter cattle prices faced by the feeder. Combining this information, the stocker operator (seller) estimates effective demand for his set of calves for the time of sale.

The feeder (buyer) uses similar information to formulate expectations of the stocker operator's offer price. The feeder considers recent buying actions of other feeders, operational costs, and expected income. Expected feedlot performance of the cattle also plays a role in the bid decision. In negotiations, the stocker operator and feeder state their offer and bid prices, respectively.

With compromise, offers and bids converge to "discover" the price for this transaction.

Intrastage Decision Risk

The above discussion of price discovery describes the interaction of production stages in the beef system. This process influences and is affected by operations within each stage. There, the beef producer faces the same basic profit equation as in Equation (1). Input costs begin with the raw material input--the beef animal itself or breeding stock to produce it. Major production costs are feed, labor, facilities, and health maintainance. Revenue for the operation comes from proceeds of sale of the cattle or beef to the next stage of activity.

First of all, the product "flows" into the operation when the animal, or its parents, are purchased from the previous stage in production. The buyer assesses demand outlook for the product at the next stage and estimates cost of production for the animal(s) being considered. These production costs are contingent upon the animals' efficiency (i.e., health, feed conversion, growth rate, etc.). Accuracy of these projections and level of risk incurred depend upon the buyer's ability to predict how the animals will perform during this production stage. The more reliable information available on the cattle at purchase, the more accurate performance prediction is expected to be. (Of course, the manager's knowledge of relationships between information and subsequent performance is a factor as well). Therefore, if the seller provides background information (such as age, breed, management practices) and/or performance measures (for example, average daily gain, weaning weight, feed conversion) on the animals, the buyer may be able to reduce the risk of producing this set of cattle.

Improved performance prediction allows for more accurate identification of the breakeven price which is important for a producer who is hedging cattle on the futures market. Hedging is a risk-reducing strategy in itself. However, the closer a hedger can come to predicting the breakeven price, the better this producer can choose if and when to "lock-in" a futures price (sell futures contracts to buy back when live animals are sold). Thus, use of futures would be an even more effective risk management tool. Similar advantages result when forward contracting, as well.

Summary

A systems approach to analysis allows for studying problems and their solutions in the context of an entire system or interrelated segments. This approach may be applied in analyses of agricultural subsectors, which are actually vertical production/marketing systems. Such a vertical system is composed of interdependent operational stages, joined at interfaces which coordinate production activities of the subsector from raw materials to retail product.

System effectiveness depends on production efficiency at each stage as well as on coordination of activities. However, system participants may erect barriers to coordination by failing to recognize existence of and production situations of other stages. Lack of communication and inaccurate pricing at interfaces also weakens system effectiveness.

Use of information in price discovery can improve system effectiveness. First of all, when more pertinant information is available at the time products are exchanged, the discovered price will be closer to the "true price," thus more accurately communicating demand back to producers from consumers. In addition, more and better information available about the input of a stage allows for more predictable performance at that stage. Thus, decision makers may better implement risk reduction strategies, expanding their management capabilities.

The beef subsector is a complex vertical system of several stages and many firms, and coordination must take place at several interfaces in the system. Therefore, participants' increased awareness of and cooperation with each other through transfer of information may improve effectiveness of the beef subsector.

CHAPTER III

PRESENTATION AND INTERPRETATION OF PRODUCER SURVEY RESULTS

One of the premises set forth in Chapter II was that using information in the price discovery process can increase the effectiveness of the beef production/marketing system. Producers first have to communicate and cooperate with each other for greater coordination to be possible. They must be aware of the relative importance of performance measures used at each stage as well as the information preferred for predicting performance at each stage. Therefore, the objectives of this study prescribe identification of these performance measures and information used by producers as the first steps toward achieving greater system effectiveness.

The Survey Method

To collect this information, 3000 questionnaires were mailed to cattle-producing members of the Oklahoma Cattlemen's Association, as described in Chapter I. Members returned 517 questionnaires with 400 members responding to parts of the marketing questions pertaining to this study (Appendix A, questions F4, F5, and F6).

The Questionnaire

On the questionnaire, producers first reported what types of enterprises are included in their beef operation. These responses provided information necessary for categorizing managers' perceptions by operational stage(s)--cow-calf, stocker, or feeder--so that these perceptions could be compared within and between stages.

For this study, survey participants were asked to respond in three main areas:

1. Importance of particular performance criteria used at cow-calf, stocker, and feeder stages, respectively;
2. Importance of various information in predicting performance of stocker and feeder cattle, respectively; and
3. Importance of specific marketing concerns associated with information available when purchasing stocker and feeder cattle, respectively.

In each area, a list of performance measures, information, or concerns was provided, and producers indicated the importance they placed on the items in each list. Importance was denoted by use of a number on a scale from 1 (least important) to 99 (most important). Therefore, respondents assigned a relative value to each performance criteria or purchasing concern. Respondents were requested to provide perceptions of not only their own production stage(s) but also other enterprises listed in the questionnaire.

Use of Data

Responses in each of the above areas were assigned to one of six categories according to operational stage(s), or enterprise(s), of the respondents. Types and numbers of cattle producers responding to one or more of the questions for this study were: 1) cow-calf only (194 respondents), 2) stocker only (31 respondents), 3) feeder only (4 respondents), 4) cow-calf/stocker (113 respondents), 5) stocker/feeder (26 respondents), or 6) cow-calf/stocker/feeder (51 respondents). These relative numbers of respondents reflect the proportion of types of beef producers in Oklahoma. As a result, some categories include relatively few responses. Therefore, inferences drawn from these categories are limited, and results cannot be conclusive.

Means of responses for each item in each question were computed for each of these producer categories. Then means were ranked in order of importance, most important (highest mean response) to least important (lowest mean response). Using these means and rankings, comparisons could be made between different items within a producer category or between the same items in different categories.

Rankings were also used to compute a Spearman rank correlation coefficient for each pair of producer categories in each question. "A correlation coefficient is a measure of the degree of closeness of the linear relationship between two variables" (Snedecor and Cochran, 1967, p. 173). The rank correlation coefficient, r_s, is the regular correlation coefficient between the ranked means of each of two producer types, X_1 and X_2. This r_s can be calculated as

$$r_s = \frac{\Sigma(X_1X_2)}{\sqrt{(\Sigma X_1{}^2)(\Sigma X_2{}^2)}} \tag{2}$$

or more easily as

$$r_s = 1 - \frac{(6\Sigma d^2)}{n(n^2 - 1)} \tag{3}$$

where d is the difference between ranks given the same item by each of two categories (Snedecor and Cochran, 1967).

The formula yields values ranging from -1 to +1, values being "close to zero when little or no correlation is present,...near 1 when the degree of correlation is high" (Meyers, 1970, p. 556). That is, a rank correlation coefficient of 0 implies no correlation, while +1 or -1 implies perfect correlation. When r_s is >0 it indicates that the rankings of X_1 and X_2 increase together. When r_s is <0, large values of X_1 are associated with small values of X_2. The r_s scale is not linear but approximately logarithmic, with r_s becoming progressively "better" as it approaches -1 or +1 (Meyers, 1970).

Results

Important Performance Criteria

Survey respondents provided their perceptions of how important they believe given performance measures are to cow-calf, stocker, and feeder producers.

Cow-calf Performance Criteria. Six performance criteria related to cow-calf production are presented in Table I with the mean response values, rankings, and number of responses associated with each. Cow-calf producers identified weaning weight as the most important performance criteria at the cow-calf production stage, as did the other non-feeder groups (stocker and cow-calf/stocker). While birth weight was assigned least importance by cow-calf operators and all other groups but one.

Table II contains a rank correlation coefficient for each possible pairing of the six producer groups. Cow-calf producers were significantly positively correlated with the other non-feeder groups (stocker and cow-calf/stocker), as were the stocker producers with cow-calf/stocker producers. That is, relative

TABLE I

IMPORTANCE OF PERFORMANCE CRITERIA FOR THE COW-CALF STAGE OF BEEF CATTLE PRODUCTION, AS PERCEIVED BY DIFFERENT PRODUCER TYPES

Performance Criteria	Rank, Mean Responses[a], and No. Observations[b] by Producer Category					
	cow-calf	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf stocker/ feeder
Weaning Weight	1 - 88.49 (194)	1 - 81.53 (17)	4*- 45.00 (2)	1 - 86.28 (113)	3 - 69.38 (8)	3 - 87.55 (51)
Average Daily Gain	2 - 83.29 (174)	4 - 73.19 (16)	3 - 50.00 (2)	4 - 81.35 (102)	1 - 76.50 (6)	4 - 83.60 (47)
Health	3 - 81.58 (168)	2 - 81.07 (15)	1*- 85.00 (2)	3 - 82.51 (102)	4 - 60.00 (7)	2 - 89.23 (44)
Death Rate	4 - 78.60 (172)	3 - 79.50 (16)	1*- 85.00 (2)	2 - 83.00 (103)	6 - 50.14 (7)	1 - 89.72 (47)
Weight/Day of Age	5 - 76.93 (168)	5 - 70.00 (17)	4*- 45.00 (2)	5 - 75.02 (101)	2 - 71.29 (7)	5 - 81.36 (47)
Birth Weight	6 - 69.21 (193)	6 - 65.76 (17)	6 - 35.00 (2)	6 - 67.32 (112)	5 - 59.38 (8)	6 - 70.64 (50)

[a] Responses were values on a scale of 1- 99, 99 being most important.
[b] Number in parentheses.
* This performance criterion is of equal importance to one or more others in this category.

TABLE II

RANK CORRELATIONS OF PERFORMANCE CRITERIA FOR THE COW-CALF STAGE OF BEEF PRODUCTION, BETWEEN DIFFERENT PRODUCER TYPES

	Spearman Correlation Coefficients by Producer Types				
Producer Type	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
cow-calf	.829*	.353	.771*	.429	.486
stocker		.530	.943*	-.029	.771*
feeder			.530	-.177	.883*
cow-calf/stocker				-.143	.829*
stocker/feeder					-.371

* Significantly correlated - - 90% probability

rankings of their responses were significantly the same. The rank correlation coefficient for the ranked responses of cow-calf and stocker producers is .829. Since this r_s approaches +1, it indicates that as the relative order of importance placed on performance criteria increases for one group, it increases for the other.

The three categories involved in cow-calf production (cow-calf, cow-calf/stocker, and cow-calf/stocker/feeder) were not all significantly positively correlated with one another. Thus they were not all consistent in the relative importance they placed on performance criteria, though they participate in a common enterprise.

Only the stocker/feeder group is not shown to be significantly positively correlated with another producer type. No two groups placed the six criteria in the exact same order of importance.

The preceding paragraphs address cow-calf producers' responses first since the question being considered relates to cow-calf production. Other sections in this chapter are discussed similarly.

An alternative approach would be to use cow-calf/stocker/feeder responses as the "norm" since this group encompasses all three stages of producers surveyed. This alternative reveals that stocker, feeder, and cow-calf/stocker producer rankings are significantly positively correlated with rankings of the vertically integrated cow-calf/stocker/feeder group. Cow-calf and stocker/feeder groups' rankings are not.

Caution must be exercised in interpreting these results. When a rank correlation coefficient indicates two groups are significantly positively correlated, it means the relative order of importance of performance criteria is the same for both groups. However, a significant rank correlation coefficient does not insure that both groups place the same weight of importance on the performance criteria.

For example, both cow-calf and stocker producers placed the greatest importance on weaning weight (Table I) and thus weaning weight was ranked number one. However, the cow-calf producers' mean response of 88.49 may be significantly more important than the 81.53 mean response of stocker producers. This study does not include a test of differences between means receiving the same rank from different producer groups.

One more consideration not addressed was the difference between response means within a producer group. For instance, cow-calf producers' mean responses to importance of weaning weight (88.49) and of average daily gain (83.29) were not tested to determine if they were significantly different. If these means are not significantly different, then they should receive the same rank. However, for this study, means within a producer group were considered different and ranked accordingly. If mean responses were exactly the same (as some feeder responses in Table I) then the same rank was given to each response.

Lastly, some producer categories included a relatively small number of responses, e.g., feeder and stocker/feeder groups (Table I). These may be too few responses upon which to base strong inferences.

Stocker Performance Criteria. Survey respondents rated four performance measures related to stocker production as shown in Table III. Stocker producers placed greatest importance on gain, as did the cow-calf/stocker group. Conversely, the stocker/feeder and cow-calf/stocker/feeder producers considered gain least important of the set, though they are also engaged in stocker enterprises. These two integrated stocker producing groups

TABLE III

IMPORTANCE OF PERFORMANCE CRITERIA FOR THE STOCKER STAGE OF BEEF CATTLE PRODUCTION, AS PERCEIVED BY DIFFERENT PRODUCER TYPES

Performance Criteria	Rank, Mean Responses[a], and No. Observations[b] by Producer Category					
	cow-calf	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
Stocker Gain	1 - 85.22 (82)	1 - 92.61 (31)	4 - 79.67 (3)	1 - 91.84 (103)	4 - 82.75 (24)	4 - 89.37 (49)
Death Rate	4 - 80.37 (83)	2 - 92.50 (30)	2 - 89.67 (3)	3 - 88.90 (106)	3 - 87.27 (26)	1 - 91.96 (50)
Health	3 - 83.30 (79)	3 - 92.42 (31)	1 - 99.00 (1)	2 - 90.19 (93)	2 - 89.23 (26)	2 - 91.57 (49)
Average Daily Gain	2 - 84.67 (87)	4 - 91.71 (31)	3 - 83.00 (3)	4 - 87.72 (102)	1 - 90.73 (26)	3 - 89.94 (50)

[a]Responses were values on a scale of 1-99, 99 being most important.
[b]Number in parentheses.

otherwise ranked the remaining three items as did the stocker only respondents. Cow-calf/stocker producers' responses differed from stockers' replies only on the "middle" two criteria. Non-feeder groups (cow-calf, stocker, and cow-calf/stocker) considered gain most important, while the feeder types all valued gain the least.

Overall, no two groups' rankings were significantly positively correlated (Table IV), while the perfectly negatively correlated pairs share a common enterprise between the compared categories. For example, stocker/feeder responses were ranked in opposite order of the stocker group's responses though both groups include stocker enterprises. No pair of the four groups engaged in stocker operations produced significant positive rank correlations for the importance of these four performance measures. Again, lack of significant positive correlation dominated the relative rankings made by all producer groups.

Feeder Performance Criteria. Table V lists feeder stage performance measures and survey results. Feeder group respondents valued efficiency and health related criteria (feed conversion, death rate, and health) most, as did the other two categories engaged in feeding (stocker/feeder and cow-calf/stocker/feeder). All three groups deemed feed conversion most important with death rate and health among the four highest values. Weight and gain measures received the lowest importance scores from feeding stage participants, as feedlot gain, slaughter weight, and carcass weight received relatively low values.

Non-feeder groups (cow-calf, stocker, and cow-calf/stocker) also placed feed conversion near the top of their scores but not necessarily so with health and death rate. They, and all groups but feeders, ranked average daily gain

TABLE IV

RANK CORRELATIONS OF PERFORMANCE CRITERIA FOR THE STOCKER STAGE OF BEEF PRODUCTION, BETWEEN DIFFERENT PRODUCER TYPES

	Spearman Correlation Coefficients by Producer Types				
Producer Type	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
cow-calf	.200	-.800	.400	-.200	-1.000**
stocker		-.400	.800	-1.000**	-.200
feeder			-.200	.400	.800
cow-calf/stocker				-.800	-.400
stocker/feeder					.200

*No two categories significantly positively correlated
**Perfectly negatively correlated

TABLE V

IMPORTANCE OF PERFORMANCE CRITERIA FOR THE FEEDER STAGE OF BEEF CATTLE PRODUCTION, AS PERCEIVED BY DIFFERENT PRODUCER TYPES

Performance Criteria	Rank, Mean Responses[a], and No. Observations[b] by Producer Category					
	cow-calf	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
Feed Conversion	2 - 85.02 (56)	3 - 90.43 (14)	1 - 94.50 (4)	2 - 88.00 (45)	1 - 94.08 (24)	1 - 92.59 (44)
Death Rate	1 - 077.57 (56)	4 - 90.14 (14)	2*- 89.75 (4)	1 - 79.91 (44)	4 - 87.04 (24)	2 - 91.02 (44)
Health	9 - 77.73 (56)	6 - 85.36 (14)	2*- 89.75 (4)	8 - 82.95 (41)	3 - 88.79 (24)	4 - 89.52 (44)
Quality Grade	6 - 83.23 (57)	8 - 83.69 (13)	4 - 87.50 (4)	5 - 84.05 (43)	5 - 86.88 (24)	6 - 87.16 (44)
Days of Feed	7 - 81.43 (56)	5 - 88.14 (14)	5*- 85.00 (4)	3 - 87.47 (45)	10 - 80.21 (24)	11 - 82.91 (44)
Yield Grade	4 - 84.48 (58)	9 - 82.92 (13)	5*- 85.00 (4)	6 - 83.98 (42)	7 - 85.21 (24)	7 - 86.98 (44)
Average Daily Gain	1 - 85.16 (55)	1 - 92.00 (15)	7 - 82.50 (4)	4 - 87.12 (43)	2 - 89.63 (24)	3 - 89.84 (43)

TABLE V (Continued)

Performance Criteria	Rank, Mean Responses[a], and No. Observations[b] by Producer Category					
	cow-calf	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
Feedlot Gain	3 - 84.60 (57)	2 - 90.53 (15)	8*- 75.00 (4)	1 - 89.27 (44)	11 - 78.17 (24)	8 - 86.04 (45)
Slaughter Weight	11 - 77.45 (56)	10 - 77.54 (13)	8* - 75.00 (4)	10 - 77.62 (42)	8 - 81.33 (24)	9 - 84.82 (44)
Dressing Percentage	5 - 84.18 (49)	7 - 84.20 (10)	10 - 60.00 (3)	7 - 83.21 (38)	6 - 85.86 (21)	5 - 87.37 (38)
Carcass Weight	8 - 79.68 (57)	11 - 79.46 (13)	11 - 57.50 (4)	9 - 80.00 (43)	9 - 80.46 (24)	10 - 83.57 (44)

[a] Responses were values on a scale 1 - 99, 99 being most important.
[b] Number in parentheses.
* Performance criterion is of equal importance to one or more others in this category.

among the highest scoring measures of performance. Weight criteria (slaughter and carcass weights) were scored relatively low by non-feeder and feeder groups. However, feedlot gain was among the three most important measures for non-feeders while in the four least important for feeder groups.

The rank correlation coefficients of Table VI show that relative responses of the three categories including feeder enterprises were significantly the same. Likewise, all three non-feeding groups showed significant positive correlation with one another.

Information Used for Predicting Performance

Survey respondents assigned a score to given descriptive information to indicate the importance of each in predicting performance of stocker and feeder cattle.

Stocker Calf Information. Twenty-one types of information which might be known about stocker cattle at purchase time are listed in Table VII. These were given scores representing the individual importance of each in predicting performance of stocker calves. The list is arranged in descending order of the stocker group's assigned values.

Responses and their relative values in each producer category appear in Table VII to vary greatly from column to column, with no readily identifiable pattern. However, some items fell consistently in the upper or lower half of the values, as ranked in order of importance, in each producer list. All producer categories scored the following among the ten most important types of information: degree of finish, frame, weighing conditions, breed, degree of muscling, and purchase weight. Receiving notably higher scores in most categories were degree of finish, frame, and weighing conditions. Valued

TABLE VI

RANK CORRELATIONS FOR IMPORTANCE OF PERFORMANCE CRITERIA FOR THE FEEDER STAGE OF BEEF PRODUCTION, BETWEEN DIFFERENT PRODUCER TYPES

	Spearman Correlation Coefficients by Producer Types				
Producer Type	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
cow-calf	.600*	.018	.818*	.236	.309
stocker		.352	.664*	.345*	.527*
feeder			.178	.645*	.627*
cow-calf/stocker				-.027	.064
stocker/feeder					.909*

* Significantly correlated - - 90% probability

TABLE VII

IMPORTANCE OF INFORMATION USED FOR PREDICTING PERFORMANCE OF STOCKER CALVES, AS PERCEIVED BY DIFFERENT PRODUCER TYPES

Descriptive Information	Rank, Mean Responses[a], and No. Observations[b] by Producer Category					
	cow-calf	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
Degree of Finish	9 - 75.00 (89)	1 - 81.22 (27)	1*- 90.00 (3)	2 - 81.80 (86)	2 - 87.21 (24)	1 - 82.60 (43)
Frame	1 - 80.77 (100)	2 - 80.96 (28)	6*- 76.67 (3)	1 - 83.03 (92)	3 - 82.50 (24)	2 - 79.67 (42)
Sex	18 - 70.10 (102)	3 - 77.07 (28)	13*- 66.67 (3)	11 - 72.39 (99)	14 - 64.50 (24)	15 - 65.11 (38)
Weighing Conditions	8 - 75.01 (86)	4 - 75.38 (26)	1*- 90.00 (3)	5 - 76.92 (87)	1 - 87.79 (24)	3 - 77.76 (42)
Breed	6 - 76.14 (101)	5 - 74.96 (26)	3*- 80.00 (3)	8 - 75.01 (91)	4 - 72.79 (24)	4 - 76.05 (41)
Degree of Muscling	4 - 78.00 (93)	6 - 70.77 (26)	9*- 73.33 (3)	7 - 75.61 (87)	5 - 70.57 (23)	6 - 74.32 (41)
Purchase Weight	7 - 75.22 (101)	7 - 67.83 (29)	8 - 75.00 (2)	4 - 77.77 (93)	8 - 68.87 (23)	5 - 74.56 (41)
Purchase Age	13 - 73.11 (100)	8 - 65.14 (29)	13*- 66.67 (3)	9 - 74.53 (95)	11 - 66.88 (24)	9 - 73.00 (42)

TABLE VII (Continued)

Descriptive Information	Rank, Mean Responses[a], and No. Observations[b] by Producer Category					
	cow-calf	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
Known Source (State or Region)	3 - 78.29 (93)	9 - 64.54 (24)	6*- 76.67 (3)	13 - 71.71 (89)	9 - 68.55 (22)	12 - 68.83 (40)
Weight/Day of Age	2 - 78.98 (93)	10 - 63.08 (25)	16 - 50.00 (3)	3 - 77.87 (87)	16 - 58.52 (21)	14 - 66.47 (38)
Historical Stocker Health (of cattle from same owner)	5 - 77.38 (85)	11 - 59.57 (21)	3*- 80.00 (3)	10 - 74.06 (81)	6*- 69.05 (22)	8 - 73.38 (39)
Birth-to-Weaning Health	11 - 74.16 (83)	12 - 58.67 (18)	15 - 56.67 (3)	6 - 75.99 (76)	12 - 65.76 (17)	13 - 67.29 (38)
Birth-to-Weaning Average Daily Gain	16 - 71.77 (90)	13 - 53.32 (22)	20*- 33.33 (3)	15 - 70.27 (75)	15 - 60.41 (22)	16 - 64.71 (38)
Historical Stocker Death Rate (of cattle from same owner)	14*- 72.60 (84)	14 - 53.10 (21)	3*- 80.00 (3)	14 - 71.43 (83)	6*- 69.05 (22)	10 - 72.10 (39)
Horned/Polled	19 - 64.42 (95)	15 - 52.73 (26)	20*- 33.33 (3)	19 - 61.98 (89)	17 - 55.78 (23)	19 - 55.95 (42)
Weaning Weight	17 - 71.39 (97)	16 - 52.09 (23)	17*- 40.00 (3)	17 - 66.08 (83)	19 - 49.95 (21)	18 - 58.62 (39)
Historical Stocker Avg. Daily Gain (of cattle from same owner)	12 - 73.32 (85)	17 - 50.73 (22)	9*- 73.33 (3)	12 - 72.32 (81)	10 - 68.43 (23)	7 - 73.50 (38)

TABLE VII (Continued)

Descriptive Information	Rank, Mean Responses[a], and No. Observations[b] by Producer Category					
	cow-calf	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
Known Management Practices (of previous owners)	10 - 74.51 (89)	18 - 48.10 (21)	9*- 73.33 (3)	16 - 68.95 (82)	13 - 64.68 (22)	11 - 68.95 (40)
Known Owner of Cattle	14*- 72.60 (95)	19 - 42.50 (24)	12 - 70.00 (3)	20 - 61.44 (87)	20 - 45.32 (22)	17 - 59.56 (41)
Birth-to-Weaning Death Rate	20 - 59.32 (78)	20 - 40.26 (19)	17*- 40.00 (3)	18 - 62.86 (73)	18 - 52.89 (18)	20 - 47.71 (35)
Birth Weight	21 - 51.01 (99)	21 - 38.75 (24)	19 - 35.00 (2)	21 - 45.71 (83)	21 - 38.43 (23)	21 - 32.71 (38)

[a] Responses were values on a scale of 1-99, 99 being most important
[b] Number in parentheses.
* This information is of equal importance to one or more others in this category.

among the ten least important items by each producer group were horn/polled, weaning weight, known owner, birth-to-weaning death loss, and birth weight. Five of the six groups scored sex and birth-to-weaning average daily gain also among their ten least important items.

Producer categories including stocker operations (stocker, cow-calf/stocker, stocker/feeder, and cow-calf/stocker/feeder) appeared in Table VII to agree with one another on general rankings, moreso than with the cow-calf and feeder groups. However, these stocker producing groups showed the most inconsistency on the importance of historical stocker information, health, sex, and weight per day of age.

In spite of the appearance of inconsistencies, the order of importance within each category of producers was significantly positively correlated with that of every other category (Table VIII). However, relatively higher rank correlation coefficients occurred between groups with common enterprises. The stocker group rankings produced higher rank correlation coefficients when paired with other groups in stocker production than with those of the cow-calf or feeder group. Likewise, all categories of feeders (feeder, stocker/feeder, and cow-calf/stocker/feeder) produced higher rank correlation coefficients when paired with one another rather than with non-feeder groups. Also, the cow-calf group produced highest rank correlation coefficients with other groups in cow-calf production (cow-calf/stocker and cow-calf/stocker/feeder). Plus cow-calf/stockers and stocker/feeders were least correlated with the enterprise "omitted" from their operation (feeder and cow-calf, respectively).

The rank correlation coefficients presented in Table VIII were tested for sensitivity by recalculating the r_s coefficients while omitting a few items from the list which were of consistent relative values within each group. For instance, weaning weight was scored relatively the same by all types of producers. Thus,

TABLE VIII

RANK CORRELATIONS FOR IMPORTANCE OF INFORMATION USED TO PREDICT PERFORMANCE OF STOCKER CALVES, BETWEEN DIFFERENT PRODUCER TYPES

	Spearman Correlation Coefficients by Producer Types				
Producer Type	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
cow-calf	.601*	.623*	.757*	.677*	.723*
stocker		.678*	.842*	.771*	.751*
feeder			.557*	.873*	.851*
cow-calf/stocker				.753*	.808*
stocker/feeder					.947*

* Significantly correlated - - 90% probability

when it was dropped from the rankings, differences between any two groups' rankings increased. That is, in the Spearman correlation coefficient formula, Equation (3), d^2 increased and thus r_s decreased. Actual rank correlation coefficents for the reduced list of information are not presented here.

Rank correlation coefficients were calculated for pairs of producer types while omitting combinations of birth weight, weaning weight, frame, breed, degree of finish, and birth-to-weaning death rate from the items ranked. (These items were of similar relative importance in each group, whether "high," "low," or "in between").

The resulting rank correlation coefficients revealed results similar to those reported in the previous sections. All stocker-producing groups were still significantly positively correlated with one another when five or fewer of the above items were left out. Plus, none of these stocker-producing groups were significantly positively correlated with any group not sharing a common enterprise with them (e.g., cow-calf/stocker with feeder). The cow-calf group was only significantly positively correlated with other groups in cow-calf production (cow-calf/stocker and cow-calf/stocker/feeder). Feeding groups were not significantly correlated with non-feeding groups unless they shared a common stage. Once again, relative responses of the producer types could be associated with one another according to common stages, suggesting lack of knowledge and/or conflict of goals between producers of different stages.

Feeder Cattle Information. Table IX presents 28 types of descriptive information which may be available on feeder cattle when purchased. Listed with these items are survey respondents' scores for the importance of each in predicting future performance. As with the stocker cattle responses, the scores and their relative values for the information varied by producer group.

TABLE IX

IMPORTANCE OF INFORMATION USED FOR PREDICTING PERFORMANCE OF FEEDER CATTLE, AS PERCEIVED BY DIFFERENT PRODUCER TYPES

Descriptive Information	Rank, Mean Responses[a], and No. Observations[b] by Producer Category					
	cow-calf	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
Degree of Finish	12 - 75.71 (65)	3 - 76.00 (13)	1*- 90.00 (3)	1 - 82.85 (48)	2 - 88.79 (14)	4 - 78.50 (38)
Weighing Conditions	14 - 75.32 (63)	1 - 84.36 (14)	1*- 90.00 (3)	3 - 80.73 (48)	1 - 86.67 (15)	5 - 77.79 (38)
Breed	19 - 73.00 (71)	6 - 68.92 (12)	3*- 80.00 (3)	15 - 73.25 (48)	6 - 79.21 (14)	11 - 74.95 (38)
Known Source (State or Region)	9 - 76.12 (67)	10 - 63.57 (14)	3*- 80.00 (3)	21 - 68.18 (49)	17 - 69.87 (15)	18 - 69.29 (38)
Historical Feeder Avg Daily Gain (of cattle from same owner)	3 - 80.58 (64)	15 - 58.83 (12)	3*- 80.00 (3)	5 - 79.35 (43)	7 - 78.35 (17)	2 - 80.35 (37)
Historical Feeder Death Rate (of cattle from same owner)	10 - 75.95 (62)	13 - 61.00 (13)	3*- 80.00 (3)	11 - 75.49 (43)	11 - 77.63 (16)	10 - 75.70 (37)
Historical Feeder Health (of cattle from same owner)	5 - 78.32 (63)	11 - 63.00 (12)	3*- 80.00 (3)	9 - 77.00 (43)	8 - 78.25 (16)	8 - 76.35 (37)
Degree of Muscling	7 - 77.45 (66)	8 - 66.07 (14)	8*- 76.67 (3)	8 - 78.11 (46)	5 - 79.87 (15)	7 - 77.00 (38)

TABLE IX (Continued)

Descriptive Information	Rank, Mean Responses[a], and No. Observations[b] by Producer Category					
	cow-calf	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
Frame	2 - 81.31 (72)	2 - 78.73 (15)	8*- 76.67 (3)	2 - 82.06 (47)	3 - 82.06 (16)	1 - 80.68 (38)
Historical Carcass Performance (of cattle from same owner)	1 - 82.43 (61)	16*- 58.00 (10)	8*- 76.67 (3)	7 - 78.74 (42)	12 - 77.53 (15)	3 - 78.85 (34)
Historical Stocker Health (of cattle from same owner)	18 - 73.20 (66)	19 - 55.08 (12)	11*- 73.33 (3)	13 - 73.89 (43)	14 - 75.21 (14)	15 - 73.34 (35)
Known Management Practices on Cattle	16 - 74.04 (68)	16*- 58.00 (13)	11*- 73.33 (3)	17 - 70.96 (48)	18 - 69.50 (14)	17 - 69.39 (36)
Purchase Age	13 - 75.65 (74)	7 - 68.67 (15)	13 - 72.50 (4)	14 - 73.27 (49)	15 - 74.88 (16)	13 - 74.11 (38)
Purchase Weight	11 - 75.78 (72)	4 - 75.87 (15)	14*- 70.00 (2)	12 - 75.46 (48)	22 - 66.33 (15)	9 - 76.30 (37)
Sex	26 - 65.93 (74)	5 - 70.47 (15)	14*- 70.00 (4)	19 - 69.04 (51)	20 - 69.13 (16)	19 - 69.26 (35)
Historical Stocker Avg Daily Gain (of cattle from same owner)	21 - 71.39 (66)	23*- 49.36 (14)	16*- 66.67 (3)	16 - 72.80 (46)	16 - 73.27 (15)	14 - 73.51 (35)
Historical Stocker Death Rate (of cattle from same owner)	22 - 70.63 (65)	22 - 49.38 (13)	16*- 66.67 (3)	20 - 69.00 (46)	9 - 77.94 (16)	16 - 71.31 (36)

TABLE IX (Continued)

Descriptive Information	Rank, Mean Responses[a], and No. Observations[b] by Producer Category					
	cow-calf	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
Known Owner of Cattle	20 - 71.93 (70)	18 - 55.29 (14)	16*- 66.67 (3)	26 - 60.07 (46)	27 - 51.79 (14)	22 - 63.41 (37)
Birth-to-Weaning Health	17 - 73.31 (58)	26 - 44.36 (11)	19 - 65.00 (2)	22 - 66.85 (46)	10 - 77.67 (12)	24 - 61.46 (35)
Stocker Health	4 - 80.37 (54)	9 - 65.07 (14)	20 - 63.33 (3)	4 - 79.60 (43)	4 - 80.21 (14)	12 - 74.72 (36)
Stocker Avg Daily Gain	8 - 77.14 (58)	14 - 60.92 (12)	21*- 60.00 (3)	10 - 76.34 (44)	19 - 69.42 (12)	6 - 77.20 (35)
Stocker Death Rate	23 - 67.00 (54)	23*- 49.36 (11)	21*- 60.00 (3)	23 - 66.08 (40)	13 - 76.92 (12)	23 - 62.74 (35)
Weight/Day of Age	6 - 78.13 (68)	12 - 61.20 (15)	23 - 53.33 (3)	6 - 78.81 (47)	21 - 68.54 (13)	20 - 67.78 (36)
Birth-to-Weaning Death Rate	27 - 59.24 (59)	28 - 36.73 (11)	24 - 43.33 (3)	27 - 53.92 (39)	24 - 58.90 (10)	27 - 45.59 (32)
Horned/Polled	25 - 66.49 (68)	20 - 53.00 (13)	25 - 40.00 (3)	24 - 65.40 (47)	25 - 57.00 (14)	26 - 59.34 (38)
Birth Weight	28 - 48.69 (70)	27 - 38.00 (14)	26 - 35.00 (2)	28 - 45.38 (48)	28 - 38.64 (14)	28 - 33.70 (37)

TABLE IX (Continued)

Descriptive Information	Rank, Mean Responses[a], and No. Observations[b] by Producer Category					
	cow-calf	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
Birth-to-Weaning Avg Daily Gain	15 - 74.78 (66)	21 - 51.50 (10)	27 - 33.33 (3)	18 - 70.69 (45)	23 - 66.00 (13)	21 - 64.34 (35)
Weaning Weight	24 - 66.76 (70)	25 - 47.85 (13)	28 - 30.00 (3)	25 - 63.35 (46)	26 - 56.62 (13)	25 - 60.41 (37)

a Responses were values on a scale of 1-99, 99 being most important
b Number in parentheses.
* This information is of equal importance to one or more others in this category.

All six categories of producers placed degree of muscling and frame consistently among the 10 most important while five of the six groups also considered degree of finish and weighing conditions in the 10 most important Historical feeder cattle data and stocker health were also consistently deemed relatively important for accurate prediction. Other information always scored among the 10 least important: weaning weight, birth weight, horn/polled, birth-to-weaning death rate. In general, cow-calf-related statistics (birth and weaning weights and birth-to-weaning measures) received relatively low scores. While sex, breed, and weight per day of age responses appeared inconsistent from category to category.

The rank correlation coefficients in Table X show all pairs of producer categories were significantly positively correlated. In general, the single-stage operator (cow-calf, stocker, and feeder) responses tended to produce higher r_S coefficients when paired with groups also containing that stage (e.g., cow-calf with cow-calf/stocker). When rank correlation coefficients were computed for the two-stage groups, pairings with the omitted category resulted in the lowest r_S (e.g., stocker/feeder with cow-calf).

As with the stocker information, rank correlation coefficients were recalculated omitting information ranked similarly (i.e., "high," "low," or otherwise) by all groups. Again, results of these new calculations are not shown. Feeder producer group responses were no longer significantly correlated with cow-calf and cow-calf/stocker groups. Also, the cow-calf group respondents were significantly correlated only with categories including a cow-calf stage. In addition, stocker and stocker/feeder groups were no longer significantly correlated. Here, group correlations and lack thereof do not as closely follow stage boundaries as with the other survey topics, yet they still

TABLE X

RANK CORRELATIONS FOR IMPORTANCE OF INFORMATION USED TO PREDICT PERFORMANCE OF FEEDER CATTLE, BETWEEN DIFFERENT PRODUCER TYPES

	Spearman Correlation Coefficients by Producer Types				
Producer Type	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
cow-calf	.553*	.509*	.824*	.548*	.779*
stocker		.680*	.725*	.550*	.704*
feeder			.613*	.724*	.753*
cow-calf/stocker				.739*	.888*
stocker/feeder					.737*

*Significantly correlated - - 90% probability suggest that producers at different stages do not clearly perceive the demands of the other stages and/or have different production goals.

Purchasing Concerns

The preceding survey results identified what criteria Oklahoma beef producers use to measure performance of their cattle and what information is useful in predicting this performance when purchasing stocker or feeder cattle. Respondents also had the opportunity to address the importance of circumstances surrounding these purchases, specifically, concerns related to available information.

Survey participants scored five general concerns related to information available when purchasing stocker calves and feeder cattle, as presented in Tables XI and XII. Inability to distinguish better performing cattle from poor performing cattle was considered the most important concern in all but two cases. In these two cases, he received the second highest score. Another performance problem, lack of uniform performance within sale lots, was deemed second most important by a majority of producer groups.

Producers of different stages may disagree on performance criteria and useful information for predicting that performance. However, they do appear to agree upon the relative significance of the need for predictable performance and uniformity of performance.

TABLE XI

IMPORTANCE OF PURCHASING CONCERNS WHEN BUYING STOCKER CALVES, AS PERCEIVED BY DIFFERENT PRODUCER TYPES

Purchasing Concerns	Rank, Mean Responses[a], and No. Observations[b] by Producer Category					
	cow-calf	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
Inability to distinguish better performing cattle from poor performing cattle in a sale lot	1 - 78.94 (79)	1 - 74.59 (27)	1*- 70.00 (3)	1 - 79.04 (80)	2 - 71.39 (23)	1 - 74.23 (43)
Lack of uniform performance within sale lots (ADG, health, feed conversion, etc.)	2 - 75.19 (75)	2 - 69.96 (23)	5 - 56.67 (3)	2 - 70.88 (78)	1 - 73.35 (20)	2 - 69.86 (44)
Inability of USDA grades or common description of cattle to predict cattle performance	4 - 67.03 (77)	3 - 64.35 (23)	4 - 63.33 (3)	5 - 63.61 (71)	4 - 64.67 (21)	3 - 62.93 (43)
Lack of universally understood terminology (Okie-1, strictly green, etc.)	5 - 65.23 (79)	4 - 63.52 (25)	1*- 70.00 (3)	3 - 65.54 (81)	3 - 68.14 (22)	5 - 62.80 (44)
Lack of information about cattle management practices of cattle being purchased	3 - 72.20 (90)	5 - 56.22 (27)	1*- 70.00 (3)	4 - 64.49 (84)	5 - 53.04 (23)	4 - 60.89 (46)

[a] Responses were values on a scale of 1-99, 99 being most important

[b] Number in parentheses.

* This information is of equal importance to one or more others in this category.

TABLE XII

IMPORTANCE OF PURCHASING CONCERNS WHEN BUYING FEEDER CATTLE, AS PERCEIVED BY DIFFERENT PRODUCER TYPES

Purchasing Concerns	Rank, Mean Responses[a], and No. Observations[b] by Producer Category					
	cow-calf	stocker	feeder	cow-calf/ stocker	stocker/ feeder	cow-calf/ stocker/ feeder
Inability to distinguish better performing cattle from poor performing cattle in a sale lot	1 - 80.11 (61)	2 - 69.88 (16)	1*- 63.33 (3)	1 - 82.77 (43)	1 - 78.50 (18)	1 - 73.73 (37)
Lack of information about cattle management practices of cattle being purchased	3 - 69.67 (69)	5 - 58.66 (15)	1*- 63.33 (3)	5 - 67.32 (44)	5 - 63.83 (18)	5 - 60.30 (40)
Lack of universally understood terminology (Okie-1, strictly green, etc.)	5 - 61.33 (61)	4 - 62.71 (14)	1*- 63.33 (3)	4 - 68.26 (39)	3 - 70.59 (17)	4 - 61.24 (38)
Inability of USDA grades or common description of cattle to predict cattle performance	4 - 67.20 (60)	3 - 68.38 (13)	4*- 60.00 (3)	3 - 68.95 (38)	4 - 66.65 (17)	3 - 63.54 (37)
Lack of uniform performance within sale lots (ADG, health, feed conversion, etc.)	2 - 76.19 (59)	1 - 71.46 (13)	4* - 60.00 (3)	2 - 72.34 (41)	2 - 77.47 (17)	2 - 71.47 (38)

a Responses were values on a scale of 1-99, 99 being most important

b Number in parentheses.

* This information is of equal importance to one or more others in this category.

CHAPTER IV

PRESENTATION AND INTERPRETATION OF PRODUCTION DATA

Survey results in Chapter III indicated the relative importance of information used in predicting performance. Thus results suggested hypotheses regarding what information should be made available to buyers of stocker and feeder cattle, so that these producers can most accurately predict cattle performance. One possible hypothesis is that the more important the information, as reported in the survey results, the greater performance predicting ability, or power, it provides. To test this hypothesis, actual production data was used to determine the contribution of available information to predicting certain types of performance.

The Procedure

Regression analysis was employed to estimate the contribution of information in predicting performance for subsequent stages of production.

Regression

Regression analysis is a statistical technique explaining changes in one (dependent) variable by relating them to changes in another (independent) variable or set of variables (Neter, Wasserman and Kutner, 1983). A multiple regression model may be expressed as:

$$Y = a + b_1X_1 + b_2X_2 + \dots + b_nX_n + e, \tag{4}$$

where

Y is the dependent variable,

X_i ($i = 1,2,...,n$) are independent variables (or regressors),

b_i are coefficients,

a is the intercept, and

e is the error term, or disturbance term.

The estimating procedure of ordinary least squares (OLS) produces the model with the intercept and the coefficients which result in the minimized sum of squared residuals. Each coefficient is equal to the covariance between its dependent variable and the independent variable, divided by the variance of the dependent variable. A coefficient estimates the rate of change in the expected value of the dependent variable with respect to one independent variable when all other independent variables are held constant.

The classical linear regression model has five assumptions (Kennedy, 1985):

1. the dependent variable can be calculated as a linear function of a specific set of independent variables, plus a disturbance term,
2. the expected value of the disturbance term is zero,
3. the disturbance terms have constant variance and are not correlated with one another,
4. the observations on the independent variable can be considered fixed in repeated samples, and
5. the number of observations are greater than the number of independent variables, and no linear relationship exists among the independent variables.

Dummy Variables. When qualitative independent variables, as opposed to quantitative ones, are included in a regression model, they may be accommodated through the use of dummy variables. Dummy variables (also known as binary or indicator variables) take on the value of "one" when the case is affirmative, "zero" otherwise (Kennedy, 1985; Rao and Miller, 1971). For example, a model may include sex as an independent variable with X_1 representing female and X_2 representing male. An observation that is female would be designated by $X_1=1$ and $X_2=0$. Once assigned, dummy variables are used in the classical linear regression model much like any other independent variable.

Dummy variables are classified into sets of variables pertaining to the same characteristic, with only one variable in each set being assigned the value "one." For instance, sex, cattle breed, and birth month could each comprise a "set" of dummy variables. "Sex" would have two classes, or variables: male and female; birth month would have up to twelve classes, one for each month of the year. Then only one regressor in each set could be designated as "one."

If an overall intercept is included in the model, as is usually the case, one of the regressors in each set is dropped from the equation, and subsequently the estimate of those omitted variables is inherent in the intercept. In the previous example for sex, only X_1 or X_2 would be included in the equation. If X_1 were the included regressor, then the estimate of the intercept term "a" would be an intercept estimate for males, and X_1 would be an estimate of the difference between the intercept for males and the intercept for females.

Adjusted R^2. The coefficient of determination, R^2, estimates the proportion, or percentage, of the total variation in the dependent variable which is "explained" by variation in the independent variable(s). Because OLS minimizes the sum of squared residuals (unexplained variation), it automatically maximizes R^2 (Kennedy, 1985).

Whether or not a set of independent variables adds to the explanation of variation in the dependent variable depends on whether or not the R^2 increases significantly when they are added. However, addition of a regressor cannot cause the R^2 to fall, for this added regressor produces at least as small a sum of squared residuals. Thus the "adjusted R^2," or "$\bar{R}^2$", is used to adjust for changes in degrees of freedom due to the added regressor(s).

$\bar{R}^2$ is based on the interpretation of R^2 being one minus the ratio of the variance of the disturbance term to the variance of the dependent variable. (Use of variances corrects for degrees of freedom.) Hence, the adjusted R^2 is estimated as:

$$\bar{R}^2 = 1 - V(e) / V(Y), \qquad (5)$$

where V(e) is the residual variance and V(Y) the variance of the dependent variable (Rao and Miller, 1971). This statistic may be more easily calculated as:

$$\bar{R}^2 = 1 - \left(\frac{t-1}{t-1}\right)(1 - R^2) \qquad (6)$$

where

K is the number of independent variables, and

T is the number of observations (Kennedy, 1985).

If an additional independent variable adds little to the explanation capability of the model, $\bar{R}^2$ falls (while R^2 rises). Thus, the $\bar{R}^2$ should be used when comparing the variation explained by relationships having different numbers of independent variables. "When adding an independent variable increases the $\bar{R}^2$, the prediction power can be increased by including that variable, because the variance of the error of prediction is thereby decreased" (Rao and Miller, 1971, p.21).

Analysis of Data

Beef cattle production data from three sources allowed for applying the survey results of Chapter III to determine actual relationships of information with performance.

The Data. Two ranches in western Oklahoma made available their records on individual cattle performance, encompassing data ranging from parentage to carcass statistics (Appendix B). These two sources provided similar information and are distinguished as Ranch A and Ranch B throughout this study. Ranch names are not used to maintain confidentiality of the data.

The Oklahoma Steer Feedout, conducted by the OSU Cooperative Extension Service, is an educational program for cow-calf producers. Each volunteer participant enters a pen of five steers to be fed out to slaughter weight, thus allowing owners to better understand the feeder stage and to witness their steers' feedlot and carcass performance. An example of the information and performance data available on these pens is also included in Appendix B.

Analysis. Information from these data sets was used in conjunction with the survey results described in Chapter III. Survey questions explored the importance of descriptive information used to predict performance and the importance of certain performance criteria. Each set of ranch data included descriptive information and measurements of performance for individual cattle.

Data corresponding to items listed in the survey questions were selected from the data for analysis. That is, descriptive information such as sex or frame score and performance measures such as slaughter weight or average daily gain were used. Each available performance measure (dependent variable) was regressed on the descriptive information (independent variables) from the data sets which could be available for predicting performance. The goal of performing this regression analysis was not to provide the "best fitting" model but rather to determine the added performance predicting capability by using available information as suggested by producer survey results.

For each equation, or model, one performance measure was regressed on the available set of information (independent variables) which was most highly ranked on the survey by the stocker or feeder producer group (Tables VII and IX). For example, if the performance measure were feedlot average daily gain and the available set of descriptive information ranked highest by the feeder group were sex, then the regression equation would be:

$$Y = a + b_1X_1 + e, \qquad (7)$$

where

Y is feedlot average daily gain,

a is the intercept for males, and

X_1 is the dummy variable for females.

The omitted variable in each set of dummy variables is the variable with the most observations for that set (in this case, male).

After this first regression was performed, a second equation was constructed by adding the next most highly ranked set of descriptive information (independent variables) to the equation. Continuing the above example, if breed had been scored by the surveyed feeders as the second most important information used in predicting feeder cattle performance, then the set of breed variables would be added to the original equation. Three breeds will be used for illustrative purposes: Angus, Brahma and Hereford. Then the next equation would be:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + e, \qquad (8)$$

where

Y is feedlot average daily gain,

a is the intercept for Hereford males,

X_1 is the dummy variable for females,

X_2 is the dummy variable for Angus, and

X_3 is the dummy variable for Brahma.

Each successive equation was constructed by adding the next most important set of descriptive information (independent variables), according to the surveyed feeders.

Results of this series of regression models would demonstrate the effect added information has on performance predicting capability. Comparisons between the resulting models are best made by comparing the $\bar{R}^2$ statistics (see above discussion) of the series of equations for each performance criteria. The $\bar{R}^2$ represents the prediction power of the descriptive information included in each equation.

The $\bar{R}^2$ represents the portion of variation in the performance criterion (dependent variable) explained by descriptive information (independent variables) included in an equation. As the explained variation increases so does predictability of the dependent variable, or performance criterion in this case. Thus, uncertainty about performance is reduced.

Results

Statistical relationships developed between performance criteria and descriptive information for stocker and feeder cattle disclosed the effect additional information might have on a producer's prediction capability.

Ranch A -- Stocker Data

Ranch A was the only data source to include stocker performance criteria and thus allow development of associations between this criteria and descriptive information for stocker calves. Stocker gain and stocker average daily gain were the only available performance criteria for this stage. Gain was considered more important by surveyed stocker producers, ranking first in importance, while average daily gain was fourth (Table III). Table XIII lists descriptive information related to stocker calves, with the items placed in descending order of importance according to the survey results (Table VII).

Table XIV encompasses results of equations regressing stocker gain on information for predicting performance. In Equation 1, gain was regressed on sex, the most important descriptive information available in this data set according to stocker producers. Adjusted coefficients of determination ($\bar{R}^2$), intercept terms (a), and the coefficients for steers (X_1) are listed in the first column in Table XIV. Calf breed, the second most important set of available information, was added to Equation 1 to produce Equation 2, with resulting estimates reported in the second column of Table XIV. Equations 3-5 resulted from the next most important set of descriptive information (according to surveyed stocker producers) being added to form each subsequent equation. The resulting adjusted coefficients of determination, in the top row, increased with each equation as a new set of regressors was added.

The increasing $\bar{R}^2$'s indicate that predictability of stocker gain increases with each set of additional information. The $\bar{R}^2$ estimate of .032 for Equation (1) means that 3.2 percent of the variation in stocker gain is "explained" by sex of a calf. In Equation (2), the estimate .093 signifies that sex and breed of a calf account for 9.3 percent of the variation in stocker gain. Thus,

TABLE XIII

KEY TO INDEPENDENT VARIABLES IN
RANCH A (STOCKER) MODELS

Variable		Description		
Sex	#1*	Heifer		
	#2	Steer		
Calf breed #1, 2*, 3, 4, 5		Each represents a different breed or crossbreed		
Birth month Jan., Feb*, Mar, Apr.		Calf born in month listed		
Weaning weight/day age				
	#1		<1.8	lb/day
	#2*	≥1.8	<2.0	lb/day
	#3	≥2.0	<2.2	lb/day
	#4	≥2.2		lb/day
Weaning weight	#1		<450	pounds
	#2*	≥450	<500	pounds
	#3	≥500	<550	pounds
	#4	≥550	<600	pounds
	#5	≥600		pounds

*This term dropped from the equation, thus no coefficient for it shows up in the tables of results.

TABLE XIV

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING STOCKER GAIN ON DESCRIPTIVE INFORMATION: RANCH A DATA[a]

	Estimates, by Equation				
	1	2	3	4	5
$\bar{R}^2$	.032065	.092765	.116192	.307649	.315621
Intercept	58.31	58.71	53.77	53.09	59.94
<u>Independent Variables</u>					
Sex #2	-11.54	-12.27	-12.27	-3.95	-4.96
Calf Breed					
#1		21.85	18.87	13.40	14.34
#3		-9.35	-8.22	-12.26	-11.25
#4		12.42	12.60	1.36	-3.47
#5		-11.91	-10.32	-23.34	-23.08
Birth month					
January			0.12	-6.39	-2.24
March			13.32	19.88	11.39
April			5.73	25.20	10.90
Weaning weight/day age					
#1				19.12	9.83
#3				-15.77	-10.38
#4				-30.75	-20.79
Weaning weight					
#1					9.02
#3					-7.81
#4					-16.34
#5					-9.10

[a]257 Observations

performance predictability was improved when knowledge of calf breed was added to that of sex.

However, the available information deemed most important by stocker producers did not contribute the most prediction power when added to the model. Instead, weight per day of age, fourth most important type of information, caused the greatest increase in $\bar{R}^2$.

Using stocker average daily gain as the dependent variable in the above equations and following the same procedure for adding independent variables produced the estimates in Table XV. Again, the adjusted R^2 statistic increased for every successive equation, as new information was included. Yet the most important information included in the equations did not contribute most to prediction ability. Table XVI summarizes the percentage of variation in the two performance criteria explained by descriptive information.

Care must be taken when interpreting the coefficients in Tables XIV and XV, and similar tables in later sections. Independent variables were not included based on t values, because they were not chosen to select the "best" model. This approach would have required omission of independent variables having insignificant coefficients.

Rather, each available set of independent variables was added to the equations in order of importance, according to survey respondents. in addition, <u>all</u> available variables within each set were added, e.g., all calf breed variables were added, not just those breeds producing significant coefficients. Therefore, the resulting equations should not be strictly interpreted, for they would not be statistically reliable. Evaluation should instead be based on the $\bar{R}^2$ estimates, measuring predictability of the independent variables.

TABLE XV

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING STOCKER AVERAGE DAILY GAIN ON DESCRIPTIVE INFORMATION: RANCH A DATA[a]

	Estimates, by Equation				
	1	2	3	4	5
$\bar{R}^2$	.031432	.092381	.112698	.307193	.314134
Intercept	.953	.960	.884	.882	.984
<u>Independent Variables</u>					
Sex #2	-.1852	-.1967	-.1966	-.0616	-.0774
Calf Breed					
#1		.3525	.3062	.2168	.2301
#3		-.1601	-.1429	-.2105	-.1943
#4		.1994	.2021	.0195	-.0564
#5		-.1943	-.1689	-.3821	-.3774
Birth month					
January			-.0090	-.1151	-.0488
March			.2051	.3115	.1788
April			.0872	.4066	.1819
Weaning weight/day age					
#1				.3000	.1556
#3				-.2701	-.1839
#4				-.5098	-.3531
Weaning weight					
#1					.1483
#3					-.1145
#4					-.2539
#5					-.1404

[a]257 Observations

TABLE XVI

SUMMARY OF ADJUSTED R^2 RESULTS FROM REGRESSING PERFORMANCE CRITERIA ON DESCRIPTIVE INFORMATION RANCH A (STOCKER) MODEL

	$\bar{R}^2$ Estimates				
	Equation Number[a]				
Dependent Variable	1	2	3	4	5
Stocker gain	.032	.093	.116	.308	.316
Stocker average daily gain	.031	.092	.113	.307	.314

[a]Equation number, set of independent variables added, and number of variables in set (in parentheses): 1-sex (1), 2-calf breed (4), 3-birth month (3), 4-weight per day of age (3), 5-weaning weight (4).

Ranch A -- Feeder Data

Ranch A data also included feedlot performance criteria and feeder cattle descriptive information. Quality grade, yield grade, feedlot average daily gain, feedlot gain, finished weight, and carcass weight were available feedlot performance measures (listed in order of importance according to surveyed feeders, as in Table V). Descriptive information used as independent variables comprise Table XVII and also appear in descending order of importance, according to surveyed feeders (Table IX).

Regressing quality grade on available information produced the estimates shown in Table XVIII. (Quality grades were converted to numerical values as reported in Appendix C). The $\bar{R}^2$ statistic generally increased as additional information increased. However, it did not increase with each successive addition of independent variables as in the stocker equations. Nor did the equation with the maximum number of regressors produce the highest adjusted coefficient of determination. In-weight and weaning weight appeared not to contribute to increased predictability of quality grade. However, descriptive information accounted for over 40 percent of the variation in quality grade in this equation. Appendix D includes results of the regression analysis of the other five performance measures (Appendix D, Tables XXX-XXXIV).

Table XIX summarizes adjusted R^2 values for all Ranch A feedlot equations. In general, including more information resulted in greater predictability of performance, though predictability did not increase with each additional set of independent variables. Also, the three most important performance criteria (quality grade, yield grade, and feedlot average daily gain) were the least predictable when regressed on four or more available types of information. The addition of sex as a regressor always resulted in increased $\bar{R}^2$

TABLE XVII

KEY TO INDEPENDENT VARIABLES IN RANCH A (FEEDER) MODELS

Variable		Description		
Calf breed #1, 2*, 3, 4, 5		Each represents a different breed or crossbreed		
In age	#1		<300	days
	#2	≥300	<325	days
	#3*	≥325		days
In weight	#1		<500	pounds
	#2*	≥500	<550	pounds
	#3	≥550	<600	pounds
	#4	≥600	<650	pounds
	#5	≥650	<700	pounds
Sex	#1*	Heifer		
	#2	Steer		
Stocker average daily gain				
	#1		< .50	lb/day
	#2	≥ .50	<1.00	lb/day
	#3*	≥1.00	<1.50	lb/day
	#4	≥1.50		lb/day
Weight/day age	#1		<1.60	lb/day
	#2	≥1.60	<1.75	lb/day
	#3*	≥1.75	<1.90	lb/day
	#4	≥1.90		lb/day
Weaning weight	#1		<450	pounds
	#2*	≥450	<500	pounds
	#3	≥500	<550	pounds
	#4	≥550	<600	pounds
	#5	≥600		pounds

*This term dropped from the equation, thus no coefficient for it shows up in the tables of results.

TABLE XVIII

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING QUALITY GRADE ON DESCRIPTIVE INFORMATION: RANCH A DATA[a]

	Estimates, by Equation						
	1	2	3	4	5	6	7
$\bar{R}^2$	.019591	.020692	.017959	.407100	.413531	.416935	.409973
Intercept	5.597	5.761	5.882	4.601	4.807	4.784	4.776
<u>Independent Variables</u>							
Calf Breed							
#1	.7069	.7177	.8195	.2724	.2601	.2440	.2151
#3	1.1803	1.1922	1.2108	.8621	1.0163	1.0413	1.0119
#4	-.3118	-.3017	-.1939	-.4604	-.4221	-.4109	-.4047
#5	.1700	.0830	.0922	-.1583	-.1173	-.1321	-.1297
ln age							
#1		-.3635	-.3509	-.2848	-.2888	-.0951	-.1580
#2		-.0624	-.0943	.0933	.1060	.1996	.1784
ln weight							
#1			-.6359	.0873	.1802	.0741	.0973
#3			-.3035	-.1328	-.0803	.0741	.0337
#4			-.0730	-.0548	.0057	.1995	.1878
#5			.1922	-.3694	-.3784	.0645	.3523

TABLE XVIII (Continued)

	Estimates, by Equation						
	1	2	3	4	5	6	7
Sex #2				2.1606	2.1963	2.1814	2.1722
Stocker average daily gain							
#1					-.4134	-.4316	-.3812
#2					.3183	-.3156	-.2857
#4					-.6394	-.6191	-.6197
Weight/day age							
#1						.0712	-.0007
#2						-.1577	-.1971
#4						-.5447	-.5225
Weaning weight							
#1							.0856
#3							.1699
#4							-.0674
#5							-.3468

[a]241 Observations

TABLE XIX

SUMMARY OF ADJUSTED R^2 RESULTS FROM REGRESSING PERFORMANCE CRITERIA ON DESCRIPTIVE INFORMATION, RANCH A (FEEDER) MODEL

	$\bar{R}^2$ Estimates						
	Equation Number[a]						
Dependent Variable	1	2	3	4	5	6	7
Quality grade	.020	.021	.018	.407	.414	.417	.410
Yield grade	.099	.092	.094	.097	.086	.089	.114
Feedlot average daily gain	.074	.077	.070	.209	.217	.212	.208
Finished weight	.090	.134	.231	.517	.522	.532	.553
Feedlot gain	.042	.046	.049	.425	.432	.429	.427
Carcass weight	.101	.146	.243	.478	.484	.494	.518

[a]Equation number, set of independent variables added, and number of variables in set (in parentheses): 1-calf breed (4), 2-in age (2), 3-in weight (4), 4-sex (1), 5-background average daily gain (3), 6-weight per day of age (3),7-weaning weight (2).

values. However, when added to the model, no other type of information always increased or always decreased predictability for all criteria.

Ranch B -- Feeder Data

Ranch B provided feeder records similar to those of Ranch A, only substituting sire breed for calf breed and omitting stocker average daily gain (Table XX). All available performance measures were the same as for Ranch A. Table XXI shows one series of regressions on descriptive information (independent variables) for Ranch B. All other such tables are in Appendix D (Tables XXXV-XXXIX).

The $\bar{R}^2$ statistics for all equation series are shown in Table XXII. The greatest predictability (highest $\bar{R}^2$ statistics) in Equations 3-7 was associated with two of the three least important performance criteria (finished weight and carcass weight). The addition of in-age and sex increased predictability for five of the six performance criteria. Conversely, the addition of weaning weight lowered $\bar{R}^2$ statistics for all performance measures. All other regressors produced varying effects on predictability when included.

Oklahoma Steer Feedout Data

The Oklahoma Steer Feedout Data included five types of information (Table XXIII) and the same performance criteria as the previous two sources: quality grade, yield grade, feedlot average daily gain, finished weight, feedlot gain, and carcass weight. Table XXIV presents the estimates obtained by regressing quality grade on a series of available information. Similar tables for other Feedout performance measures are in Appendix D (Tables XL-XLIV).

Table XXV includes all adjusted coefficients of determination for the Feedout data regression series. In general, performance prediction ability,

TABLE XX

KEY TO INDEPENDENT VARIABLES IN RANCH B MODELS

Variable		Description		
Sire breed #1, 2, 3*, 4		Each represents a particular herd bull		
In age	#1		<400	days
	#2	≥400	<425	days
	#3*	≥425		days
In weight	#1		<500	pounds
	#2	≥500	<550	pounds
	#3*	≥550	<600	pounds
	#4	≥600	<650	pounds
	#5	≥650		pounds
Sex	#1	Heifer		
	#2*	Steer		
Weight/day age	#1		<1.3	lb/day
	#2	≥1.3	<1.4	lb/day
	#3	≥1.4	<1.5	lb/day
	#4*	≥1.5		lb/day
Weaning weight	#1		<500	pounds
	#2*	≥500	<550	pounds
	#3	≥550	<600	pounds
	#4	≥600		pounds

*This term dropped from the equation, thus no coefficient for it shows up in the tables of results.

TABLE XXI

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING QUALITY GRADE ON DESCRIPTIVE INFORMATION: RANCH B DATA[a]

	Estimates, by Equation					
	1	2	3	4	5	6
$\bar{R}^2$	.228289	.259082	.280780	.320730	.332389	.302455
Intercept	7.11	7.60	7.78	7.33	6.89	6.73
<u>Independent Variables</u>						
Sire Breed						
#1	.1436	.1407	-.0039	-.4499	-.6605	-.6260
#2	-.4141	-1.2461	-1.0776	-1.0098	-1.1278	-1.0770
#4	-.1064	.0623	.0966	.2092	.1803	.2868
ln age						
#1		-.6855	-.6826	-.3977	-.3105	-.2068
#2		-.6603	.7005	-.4347	-.2507	-.2118
ln weight						
#1			-.7374	-.8270	-.5074	-.4319
#2			.1929	-.1444	.0900	.1159
#4			-.3641	-.2347	.0205	-.0323
#5			-66.96	-.4635	-.1364	-.2647
Sex #1				.6969	.8539	.8530

TABLE XXI (Continued)

	Estimates, by Equation					
	1	2	3	4	5	6
Weight/day age						
#1					-.6497	-.5418
#2					.3568	.4285
#3					.2811	.3184
Weaning weight						
#1						-.1816
#3						.0476
#4						.2374

[a] 72 Observations

TABLE XXII

SUMMARY OF ADJUSTED R^2 RESULTS FROM REGRESSING PERFORMANCE CRITERIA ON DESCRIPTIVE INFORMATION, RANCH B MODEL

Dependent Variable	$\bar{R}^2$ Estimates					
	Equation Number[a]					
	1	2	3	4	5	6
Quality grade	.228	.259	.281	.321	.332	.302
Yield grade	.012	.097	.005	.135	.110	.087
Feedlot average daily gain	.080	.201	.177	.249	.236	.229
Finished weight	.022	.205	.554	.549	.559	.556
Feedlot gain	.058	.165	.141	.155	.141	.131
Carcass weight	.026	.233	.509	.520	.534	.531

[a]Equation number, set of independent variables added, and number of variables in set (in parentheses): 1-sire breed (3), 2-in age (2), 3-in weight (4), 4-sex (1), 5-weight per day of age (3), 6-weaning weight (3).

TABLE XXIII

KEY TO INDEPENDENT VARIABLES IN OKLAHOMA STEER FEEDOUT

Variable		Description		
Sire Breed	#1	Angus		
	#2	Brangus		
	#3	Charolais		
	#4	Gelbvieh		
	#5*	Hereford		
	#6	Simmental		
Frame	#3	Frame score 3		
	#4*	Frame score 4		
	#5	Frame score 5		
	#6	Frame score 6		
Birth month	Feb., Mar.,* Apr., Sept., Oct., Nov.	Calf born in month listed		
In weight	#1		<500	pounds
	#2	>500	<550	pounds
	#3	>550	<600	pounds
	#4*	>600	<650	pounds
	#5	>650	<700	pounds
	#6	>700		pounds
Owner #1*, 2, 3, 4, 5, 6		Each represents a different owner of steers		

*This term dropped from the equation, thus no coefficient for it shows up in the tables of results.

TABLE XXIV

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING QUALITY GRADE ON DESCRIPTIVE INFORMATION: OKLAHOMA STEER FEEDOUT DATA[a]

	Estimates, by Equation				
	1	2	3	4	5
$\bar{R}^2$	.073868	.110094	.102238	.066865	.129859
Intercept	5.62	5.59	5.64	5.92	5.07
Independent Variables					
Sire Breed					
#1	1.0356	1.1177	.8938	.9133	.5679
#2	-.2154	-.0190	-.2612	.0911	.0543
#3	-.4904	.2333	.3377	.3532	1.0008
#4	-.4154	-.0171	-.9013	-.5905	1.1976
#6	.3846	1.0925	1.0253	.9745	1.1155
Frame 3		.4970	-.0808	-.1612	-.1768
Frame 5		-.1582	-.1404	-.4039	-.3492
Frame 6		-1.2428	-1.2066	-1.5559	-1.6307
Birth month					
February			-1.2374	-1.2309	-.9178
April			-.0466	.2164	.6221
September			.8161	.4737	-.3666
October			.2277	.0432	-.2390
November			-.1025	.0248	.0968
In weight					
#1				-.7964	.1338
#2				-.3856	.5131
#3				-6403	.3843
#5				.0607	.4906
#6				.0134	.3323
Owner					
#2					-.4680
#3					1.5352
#4					-.4904
#5					-.5550
#6					1.0105

[a]97 Observations

TABLE XXV

SUMMARY OF ADJUSTED R^2 RESULTS FROM REGRESSING PERFORMANCE CRITERIA ON DESCRIPTIVE INFORMATION, OKLAHOMA STEER FEEDOUT MODEL

	$\bar{R}^2$ Estimates				
	Equation Number[a]				
Dependent Variable	1	2	3	4	5
Quality grade	.074	.110	.102	.067	.130
Yield grade	.077	.066	.050	.065	.235
Feedlot average daily gain	.127	.082	.158	.191	.266
Finished weight	.339	.372	.442	.707	.724
Feedlot gain	.120	.232	.395	.445	.468
Carcass weight	.325	.384	.429	.666	.672

[a]Equation number, set of independent variables added, and number of variables in set (in parentheses): 1-sire breed (5), 2-frame (3), 3-birth month (5), 4-in weight (5), 5-owner (5).

indicated by $\bar{R}^2$ estimate, was lowest for the three most important performance criteria (quality grade, yield grade,and feedlot average daily gain) and highest for the three least important performance criteria (finished weight, feedlot gain, and carcass weight). Additional information sometimes increased, but sometimes decreased, $\bar{R}^2$ values for the first three performance criteria yet always improved prediction ability in the latter three. Owner information and in-weight each caused $\bar{R}^2$ statistics to increase for all but one performance criteria.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The beef production/marketing system consists of several stages of production, with managers at each stage employing their own criteria for measuring cattle performance. Performance criteria emphasized at one stage may differ from and possibly conflict with those at other stages, due to differing production goals and/or lack of knowledge of other stages. Resolution of these conflicts and improved understanding between stages could allow for improved system efficiency through vertical coordination.

Producers in the beef system have expressed concern over their inability to predict performance when purchasing cattle under normal conditions. Buying "on the average" is a common result of this problem. Being able to distinguish better performing cattle from poorer performing cattle could contribute to system efficiency by reducing production risk and improving pricing accuracy, thus benefitting both buyers and sellers.

One of the objectives of this study was to identify performance criteria and information used by producers to predict this performance for cow-calf, stocker, and feeder stages of the beef subsector. Once identified, the performance criteria and their relative importance were compared between stages to determine if and where inconsistencies exist. In addition, regression models were used to determine the contribution of descriptive information to predicting cattle performance.

Identifying Important Performance Criteria and Information

Oklahoma Cattlemen's Association members were surveyed to determine the importance of given performance criteria and of information for predicting cattle performance in their own and other stages of beef production. Survey responses were classified into producer categories according to the stage(s) of the survey respondent: cow-calf, stocker, feeder, cow-calf/stocker, stocker/feeder, or cow-calf/stocker/feeder. Then the scores indicating importance of criteria and information were ranked within each producer group.

These responses revealed which criteria and which types of information were considered valuable by producers at each stage. Spearman rank correlation coefficients (r_S) revealed which groups were significantly correlated in terms of the relative importance they placed on performance criteria and descriptive information. Significant positive correlation between producer groups occurred more frequently if these groups participated in at least one common stage of production. In general, responses of groups engaged in feeding operations (feeder, stocker/feeder, and cow-calf/stocker/feeder groups) tended to be significantly positively correlated, while categories not including feeding (cow-calf, stocker, and cow-calf/stocker) also tended to rank performance criteria consistently with one another.

When ranking cow-calf performance criteria, cow-calf, stocker, and cow-calf/stocker producers' were all significantly positively correlated with one another. Also, cow-calf/stocker/feeder rankings were significantly positively correlated with those of stocker, feeder, and cow-calf/stocker groups. No two producer groups placed the same relative importance on stocker performance criteria, as none were significantly positively correlated. For feeder stage performance criteria, relative responses of the three categories including feeder enterprises (feeder, stocker/feeder and cow-calf/stocker/feeder) were significantly the same. Likewise, all three non-feeding groups (cow-calf, stocker and cow-calf/stocker) showed significant positive correlation with one another.

Rankings of stocker and feeder information for predicting performance were all significantly the same for all producer groups. However, in each case, rank correlations were recalculated after omitting information receiving consistent rankings from all groups. The resulting rank correlations revealed results similar to those reported for cow-calf and feeder performance criteria. Relative responses of producer types could be associated with one another according to common stages.

Relating Information to Performance

Performance data made available for the study allowed for determining relationships between available information and performance predictability. Each available performance measure for stocker or feeder cattle was regressed on dummy variables representing descriptive information included in the data sets.

A general procedure was followed to estimate the equations for each performance criterion. In the first equation, the performance criterion (dependent variable) was regressed on the one type of available information deemed most important by the appropriate survey group--stocker or feeder. In the second equation, the same criterion was regressed on the two most important types of information. Then the third most important information was added to the equation, and so on. Importance of the descriptive information, according to the survey results, determined the order for adding these independent variables to the equations. Also, all available variables within each type of information were used, not just those with significant coefficients.

Adjusted coefficients of determination ($\bar{R}^2$), calculated for each equation, estimated the proportion of dependent variable (performance measure) variation explained, or predicted, by the independent variables (information). Comparing the $\bar{R}^2$ statistics of equations with the same performance measure revealed whether additional information increased or decreased prediction power. These $\bar{R}^2$ values also showed the relative importance of different types of information used in predicting specific types of performance.

In general, as more information was included in a model, its $\bar{R}^2$ increased. Therefore, increased use of information resulted in improved prediction ability. In some cases, the addition of a set of independent variables did not produce a higher $\bar{R}^2$, thus indicating the new information did not contribute to performance predictability. In other cases, inclusion of some sets of information increased predictability in some but not all equations.

As different sets of independent variables (information) were added to the models, they increased the $\bar{R}^2$ statistics by varying degrees. Some information increased performance predictability more than other information. However, the most important information according to survey responses did not often add the most predictability to a model, while addition of less important information according to respondents sometimes increased predictability more than any other set of information.

The more important available performance criteria, according to survey results, were not necessarily the most predictable criteria. Instead, relatively higher $\bar{R}^2$ estimates were associated with equations containing less important performance criteria.

Conclusions and Implications

Survey results led to the conclusion that inconsistencies exist among performance criteria used by producers at different stages of beef production. Relative importance of performance criteria could become more highly correlated, or more consistent among stages, by resolving conflicts and/or increasing understanding between stages. Providing more information to potential buyers about cattle being sold could reduce these conflicts and lack of understanding.

However, producers (sellers) must have an incentive to record and provide information. This incentive may be reduced costs or increased income for the producer. Improved ability to predict performance could create one or both incentives. As predictability of performance increases, uncertainty of performance decreases, reducing production risk. For example, when predicting average daily gain for a pen of feeder cattle, a producer might predict performance with an error rate of 10 percent. This error in predicting rate of gain could result in a significant difference in the producer's estimated cost of production. Therefore, a decrease in the variability or error of prediction would decrease the producer's risk.

Results from the models determining contribution of information to performance predictability suggest that use of additional information improves performance predictability, in general. Therefore, use of available information could contribute to the reduction of production risk by improving predictability. As a result, cattle buyers could benefit from acquiring descriptive information about the prospective purchases, and be willing to pay for the reduced risk provided by additional information. Buyers would benefit as long as the cost of information is no greater than the value of the reduced risk. In addition, buyers would need assurance of the reliability of the information.

Once buyers are willing to compensate sellers for additional information, sellers should be motivated to record and provide information for cattle they sell. Sellers will provide information to buyers only if the cost of recording information is less than the premium paid (or lack of discount) for information and the resulting performance predictability. Producers may also benefit from recording information for their own use in predicting performance in later stage of production.

Public or private programs could be implemented to facilitate marketing of cattle by applying this concept of increasing information provided to buyers from seller, thereby increasing performance predictability. For instance, a listing of feeder cattle producers and descriptions of their available lots could be compiled and disseminated to prospective buyers. Descriptions could include more and better information for predicting performance than would ordinarily be available to buyers. Program coordinators could possibly aid the sellers in collecting and/or recording desired information. Buyers using the listing would want to be assured of accurate and honest information.

The survey results suggested types of information considered important by beef producers for predicting performance. However, these results may not be a reliable guide for determining which information contributes most to performance prediction, for producer groups did not necessarily agree on relative importance of different types of information. Then, information was used in regression equations to determine its contribution to performance predictability. Regression results suggested that more information improves prediction power. However, not all available sets of information contributed to performance predictability. In addition, the information that did increase predictability, not all sets contributed in the order of importance indicated by survey respondents.

Surveyed producers may not have been aware of the true relationships between available information and performance and thus did not prioritize the information properly. Possibly, no single ranking of the importance of information is appropriate for predicting several performance criteria. Different information may be needed to accurately. predict different cattle performance criteria. Lastly, data used for the regression models may have had unknown problems such as inaccurate or biased recording of information.

More research is needed to determine what descriptive information should be recorded and made available. Further research could also focus on how to accurately record descriptive information and how to effectively disseminate the information to buyers. Finally, research is needed to determine the value of increasing performance predictability to buyers.

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APPENDIXES

APPENDIX A

OKLAHOMA BEEF PRODUCER SURVEY

CONFIDENTIAL CONFIDENTIAL

CATTLE OPERATION PROFILE AND MARKETING SURVEY
Oklahoma Cattlemen's Association and
Agricultural Economics Department, Oklahoma State University

Please complete the following as accurately and completely as possible. Reasonable estimates should be used when exact figures are not known. If the question does not apply, leave blank. Answers should reflect 1985 actions. Use the margins, back, or additional paper for supplementary comments.

SECTION A: General Operation Information

1. Do you own or manage a beef cattle breeding herd? __ Yes __ No
   * If yes, what type of herd? __ Commercial __ Registered __ Both
   * What is the approximate size of your breeding herd?
   No. cows ______

2. Do you own or manage a stocker operation? __ Yes __ No
   * If yes, how many stocker cattle did you sell in 1985? __________

3. Do you own or manage a beef cattle feeding operation? __ Yes __ No
   * If yes, what best describes your operation?
   __ Commercial feeder __ Farmer feeder __ Custom feeder
   * How many cattle were slaughtered from your lot in 1985? ___

4. Do you have your cattle custom fed in a feedlot? __ Yes __ No
   * If yes, how many slaughter cattle did you sell in 1985? ______

5. In what section of Oklahoma is your cattle operation PRIMARILY located? (Assume I-35 divides the state east to west and I-40 divides the state north and south. The Panhandle includes the 3 most western counties.)
   __ Southeast __ Southwest
   __ Northeast __ Northwest
   __ Panhandle __ Other state (please specify) ____________

SECTION B: Animal Health

1. Which of the following diseases do you vaccinate for?
   __ Black Leg/Malignant Edema __ E. Coli __ Other (please specify)
   __ Vibriosis __ BVD
   __ IBR __ Brucellosis
   __ Pl-3 __ Leptospirosis
   * How much did you spend on vaccines in 1985? ___________

2. Which of the following diseases did you treat for?
   __ Calf Scours __ Foot Rot __ Other (please specify) ____________
   __ Bloat __ Respiratory Disease
   __ Anaplasmosis __ Pinkeye
   __ Coccidiosis __ Calf Pneumonia
   * How much did you spend on disease treatments in 1985? ____________

3. Which of the following parasites do you treat for?
   __ Grubs __ Horn flies __ Intestinal worms
   __ Lice __ Lung worms __ Other (please specify) ____________
   __ Ticks __ Face flies
   *How much did you spend on parasite control in 1985? ______________

4. Do you use growth promotants? __ Yes __ No
   * If so, what type do you use? __ Implant __ Feed additive
   * What brand do you use?____________________

5. Do you use antibiotics in your operation? __ Yes __ No
   * If so, what brand do you use?__________________

6. Do you use artificial insemination? __ Yes __ No
   * If yes, do you use a heat synchronization product? __ Yes __ No
   * What brand do you use?__________________
   * How many cows and heifers did you breed A.I. in 1985?__________

SECTION C: Ranch Description

1. How many acres are owned or leased in your entire operation?____________
   * How many acres are:
   Owned range _______ Owned pasture _______ Owned farmland _______
   Leased range _______ Leased pasture _______ Leased farmland _______

2. Do you do anything to improve your __ Range __ Pasture
   __ Controlled grazing
   __ Mechanical brush & weed control __ Fertilize
   __ Chemical brush & weed control __ Reseed

3. Do you raise hay or alfalfa? __ Yes __ No
   * If yes, how many hay and alfalfa acres did you farm in 1985?__________
   * How many tons did you put up in 1985?__________
   * Do you green chop? __ Yes __ No

4. How much did you spend on fertilizer in 1985?____________

5. How much did you spend on pesticides, herbicides and fungicides in 1985?________

6. Please check the forage equipment you use.
   __ Conventional baler __ Swather __ Silage bagger
   __ Large round baler __ Rake __ Mower
   __ Large square baler __ Hay stacker __ Other
   * How much did you spend on haying equipment in 1985?____________
   * Do you plan on purchasing haying equipment in the next 24 months?
   __ Yes __ No

SECTION D: Miscellaneous

1. In your cow/calf or stocker operations do you supplement your cattle with a
   __ Complete feed __ Mixed feed supplement __ Liquid supplement
   __ Mineral block __ Molasses block

2. How much did you spend on feeding and feed processing equipment in 1985?________

3. Do you use ear tags to identify your cattle? __ Yes __ No
   * If yes, what brand?________________
   * Do you use insecticide ear tags on your cattle? __ Yes __ No
   * If yes, what brand?________________

4. Do you own a personal computer? __ Yes __ No
   * If yes, do you use it in your cattle operation? __ Yes __ No

SECTION E: Seedstock Replacement

1. How many bulls did you purchase (for breeding) in 1985?______________

2. Do you buy bulls at __ Auction sales __ Private treaty
   * How much do you generally spend when buying bulls?
   __ $500-$999 __ $1000-$1499 __ $1500-$2000 __ Over $2000

3. How far will you normally travel to buy bulls
   __ Less than 100 miles __ 100-249 miles __ 250-500 miles __ Over 500

4. Do you use embryo transfer in your breeding operation? __ Yes __ No

5. When do you start shopping for and buying bulls?
   __ Fall __ Winter __ Spring __ Summer

6. Please check the breeds of bulls you plan to purchase in the next 12 months:

__ Hereford	__ Angus	__ Brangus	__ Polled Hereford
__ Simmental	__ Charolais	__ Limousin	__ Shorthorn
__ Brahman	__ Red Angus	__ Saler	__ Beefmaster
__ Chianina	__ Longhorn	__ Simbrah	__ Santa Gertrudis

7. How many replacement heifers do you plan to purchase in the next 12 months?______________ retain from your herd in the next 12 months?______________

8. Do you plan to buy crossbred or straightbred heifers?
   __ Crossbred __ Straightbred
   * Which breed or breed combinations do you plan to purchase?
   (Please list)____
   ____

SECTION F: Marketing

1. What percentage of each type of cattle you sold in 1985 were marketed by the following methods?

	Percentage			
	Cull Cows	Calves or stockers	Yearlings or feeders	Fed cattle
a. Local auction	____	____	____	____
b. Oklahoma City or Tulsa stockyards	____	____	____	____
c. Direct to buyer (through a commission salesman)	____	____	____	____
d. Direct to buyer (without a commission salesman)	____	____	____	____
	100%	100%	100%	100%

2. Do you use futures markets to hedge feeder cattle? __ Yes __ No
fed cattle? __ Yes __ No

3. Do you use options markets to price fed cattle? __ Yes __ No

The next 3 questions are to be answered by using numerical scores ranging from 1 to 99. The numbers 1 and 99 represent extremes in importance. The number 1 means no importance while 99 means highly important. Use ANY number along the range (from 1 to 99) which best expresses your judgement of importance.

4. Indicate the importance of each cattle performance criteria as you perceive it for <u>each</u> type of cattle business. Respond in all areas you have knowledge of even if they are not part of your operation. If you don't know, leave blank.

Importance of Performance Criteria
The following scale may help keep the directions in mind:

1	10	20	30	40	50	60	70	80	90	99
Not Important				Moderately Important					Highly Important	

Performance criteria	Importance for Cow-calf	Stocker	Feeder
Birth weight	______	xxxxxxx	xxxxxxx
Weaning weight	______	xxxxxxx	xxxxxxx
Weight per day of age	______	xxxxxxx	xxxxxxx
Birth-to-weaning growth rate (ADG)	______	xxxxxxx	xxxxxxx
Birth-to-weaning death loss	______	xxxxxxx	xxxxxxx
Birth-to-weaning health	______	xxxxxxx	xxxxxxx
Other (Please explain)	______		
Total stocker gain	xxxxxxx	______	xxxxxxx
Stocker growth rate (ADG)	xxxxxxx	______	xxxxxxx
Stocker death loss	xxxxxxx	______	xxxxxxx
Stocker cattle health	xxxxxxx	______	xxxxxxx
Other (Please explain)	______		
Total feedlot gain	xxxxxxx	xxxxxxx	______
Total days on feed	xxxxxxx	xxxxxxx	______
Feedlot growth rate (ADG)	xxxxxxx	xxxxxxx	______
Feedlot feed conversion	xxxxxxx	xxxxxxx	______
Feedlot death loss	xxxxxxx	xxxxxxx	______
Feedlot animal health	xxxxxxx	xxxxxxx	______
Mature (finished) live weight	xxxxxxx	xxxxxxx	______
Carcass weight	xxxxxxx	xxxxxxx	______
Quality grade at market weight	xxxxxxx	xxxxxxx	______
Yield grade at market weight	xxxxxxx	xxxxxxx	______
Dressing percentage at market weight	xxxxxxx	xxxxxxx	______
Other (Please explain)	______		

5. Assume you wanted to buy high performing stocker or feeder cattle. Indicate the importance of the following descriptive information would have in helping you predict cattle performance in a stocker or feeding program. Fill in both stocker and feeder columns. If you don't know, leave blank.

Importance in predicting cattle performance
The following scale may help in keeping the directions in mind:

1	10	20	30	40	50	60	70	80	90	99
Not Important				Moderately Important				Highly Important		

	Importance for Stocker cattle	Importance for Feeder cattle
a. Sex	______	______
b. Age when purchased	______	______
c. Purchase weight	______	______
d. Birth weight	______	______
e. Weaning weight	______	______
f. Weight-for-age	______	______
g. Frame size	______	______
h. Breed type(s)	______	______
i. Degree of muscling	______	______
j. Degree of finish or condition when purchased	______	______
k. Weighing conditions (pencil shrink, time off feed or water, time of day loaded)	______	______
l. Horned, polled, dehorned/tipped cattle	______	______
m. Birth-to-weaning growth rate (ADG)	______	______
n. Stocker growth rate (ADG)	xxxxxxx	______
o. Birth-to-weaning death loss	______	______
p. Stocker death loss	xxxxxxx	______
q. Birth-to-weaning health	______	______
r. Stocker health	xxxxxxx	______
s. Known owner of cattle	______	______
t. Known source of cattle (state or region)	______	______
u. Known management practices on cattle	______	______
v. Historical stocker growth rate (ADG) of cattle from same owner	______	______
w. Historical stocker death loss of cattle from same owner	______	______
x. Historical stocker health of cattle from same owner	______	______
y. Historical feedlot growth rate (ADG) of cattle from same owner	xxxxxxx	______
z. Historical feedlot death loss of cattle from same owner	xxxxxxx	______
aa. Historical feedlot health of cattle from same owner	xxxxxxx	______
bb. Historical carcass performance (grade and yield grade) of cattle from same owner	xxxxxxx	______
cc. Other (please explain)	______	

6. Indicate how important you perceive each of the following are when buying stocker cattle and feeder cattle. Fill in stocker <u>and</u> feeder columns. If you don't know, leave blank.

Importance in purchasing
The following scale may help keep the directions in mind:

1	10	20	30	40	50	60	70	80	90	99
Not Important				Moderately Important				Highly Important		

Purchasing concern	Importance for: Stocker cattle	Importance for: Feeder cattle
a. Lack of information about cattle management practices of cattle being purchased	______	______
b. Lack of universally understood terminology (Okie-1, strictly green, etc.)	______	______
c. Inability of USDA grades or common description of cattle to predict cattle performance	______	______
d. Lack of uniform performance within sale lots (ADG, feed conversion, health etc.)	______	______
e. Inability to distinguish better performing cattle from poor performing cattle in a sale lot	______	______

THANK YOU FOR PARTICIPATING IN THIS SURVEY!

An article summarizing parts of this survey will appear in the COWMAN magazine. Other parts will be included in an OSU report. If you would like a copy of the OSU publication, please provide us with your name and address.

Name: ______________________________

Address: ______________________________
____
____

Clem Ward

APPENDIX B

SAMPLES FROM DATA SETS

TABLE XXVI

RANCH A: SAMPLE OF AVAILABLE DATA

SEX OF CATTLE:	HEIFER	11/08/84:WEANING DATE	USDA CHOICE VALUE/CWT:
NO. OF HD AT BGRD:	145	11/08/84:OFF WEAN DATE	USDA GOOD VALUE/CWT:
		01/08/85:OFF BACKGROUND DATE	USDA STANDARD VALUE/CWT:
		:CHECK WEIGHT DATE	DISCOUNT/CWT Y'4S:
NO. OF HD AT FNSH:	125	05/24/85:FINISH DATE	

==============GENERAL DATA====================

LOC	USDA	** DAM	**		SIRE		**** CALF	***		** WEANING	DATA **		****	BACKGROUND	DATA		****		******
TAG#	TAG#	ID	BRD	AGE	ID	BRD	BRD	STATE	WGHT	AGE	WGHT	205	IND	WTIN	WTOUT	AGE	GAIN	G/DY	IND	WTIN
200	466		AH	11			CAH	22484		258	450	372	0.90	450	520	319	70	1.14	1.19	520
347	L445		AH	11			CAH	02/07		275	560	435	1.06	560	590	336	30	0.49	0.51	590
305	422		AH	11			CAH	21984		263	560	452	1.10	560	560	324	0	0	0	560
258	L310		AH	11			CAH	01/29		[illegible]	[illegible]	467	1.14	[illegible]	670	345	50	0.81	0.85	670
257	302		AH	11			CAH	21084		272	505	398	0.97	505	500	333	-5	-0.0	-0.0	500
354	410		AH	11			CAH	32984		[illegible]	450	418	1.02	450	525	285	75	1.22	1.28	525
386	407		AH	11			CAH	20584		276	540	419	1.02	540	575	337	35	0.57	0.59	575
332	[illegible]		AH	11			CAH	21984		263	555	448	1.09	555	615	324	60	0.98	1.02	615
336	437		AH	11			CAH	20384		279	550	423	1.03	550	615	340	65	1.06	1.10	615
251	323		AH	11			CAH	21084		272	580	454	1.11	580	610	333	30	0.49	0.51	610
230	456		AH	11			CAH	20184		281	435	336	0.82	435	495	342	60	0.98	1.02	495
243	423		AH	11			CAH	22584		257	600	493	1.20	600	660	318	60	0.98	1.02	660
234	305		AH	11			CAH	20184		281	505	387	0.94	505	585	342	80	1.31	1.36	585
139	452		AH	11			CAH	22584		257	535	441	1.07	535	560	318	25	0.40	0.42	560
249	454		AH	11			CAH	21484		268	495	395	0.96	495	520	329	25	0.40	0.42	520
426	409		AH	10			CAH	21484			[illegible]	491	1.19	[illegible]	640	329	20	0.32	0.34	640

TABLE XXVI (Continued)

SEQUENCE: BREED AND AGE OF DAM

FEEDYARD DATA							CARCASS DATA								
G/DY	IND	AGE	FNWT	G/DY	IND	WT	MTR	MRB	THK	R/E	KPH	FQC	QLT	YGR	VALUE
		484	986	2.82	1.02	647	A	SL-		12.5	1.5		G-	3.2	517.60
		501													
		489	939	2.29	0.83	616	A	T+		12.4	1.0		ST+	2.5	462.00
		510													
		498	1050	3.33	1.20	683	A	SL-		12.8	2.0		G-	3.3	551.[illegible]
		450	1073	3.31	1.20	706	A	SL+		13.0	2.0		G+	3.6	56[illegible].60
		502	1035	2.78	1.00	679	A	SM		13.5	1.5		C-	2.9	577.15
		489	1204	3.56	1.29	790	A	SL-		12.8	1.0		G-	2.6	632.00
		505	1071	2.76	1.00	703	A	T+		15.0	1.5		ST+	3.2	527.25
		498	1044	2.62	0.95	685	A	T+		12.0	2.5		ST+	3.5	513.75
		507	948	2.74	0.99	622	A	SM		11.6	2.0		C-	3.5	528.70
		483	1152	2.98	1.08	755	A	[illegible]		13.4	2.0		G+	3.6	60[illegible].90
		507	1179	3.60	1.30	774	A	SL+		13.2	3.0		G+	3.6	619.20
		483	964	2.45	0.88	633	A	T+		12.2	1.5		ST+	2.9	474.75
		494	971	2.73	0.98	637	A	SL-		11.9	1.5		G-	3.0	509.60
		494	948	1.86	0.67	622	A	T+		12.2	1.0		ST+	2.6	[illegible]

TABLE XXVII

RANCH B: SAMPLE OF AVAILABLE DATA

SEQUENCE: USDA TAG

RANCH	USDA	SIRE	*******	DAM*****		BIRTH	WEAN	ADJ	INDX	AGE	WT.	ADJ YR	INDX	CHK	GAIN
TAG	NO	BREED	BREED	AGE	ET	DATE	WT.	205		TO YD	TO YD	WT.		WT	/DAY
WH053	557	LINC/RED	ANGUS	5	165	11/25/84	600	624	1.16	376	620	620	1.05	875	3.31
BL119	558	LIMOUSIN	ANGUS	7	724	10/26/84	575	534	0.99	406	620	602	1.02	860	3.12
YL098	559	LIMOUSIN	ANGUS	9	731	12/10/84	550	591	1.10	361	600	600	1.02	775	2.27
BL127	560	LIMOUSIN	ANGUS	3	740	10/29/84	525	498	0.92	403	600	590	0.99	880	3.64
YL014	561	LINC/RED	ANGUS	10	860	10/12/84	650	577	1.07	420	620	609	1.04	910	3.77
BK007	562	93/BL EYE	ANGUS	8	380	10/08/84	660	582	1.08	424	685	657	1.12	935	3.25
WH018	563	LINC/RED	ANGUS	10	252	10/03/84	600	522	0.97	429	621	593	1.01	930	4.01
YL081	564	LINC/RED	CHARXANG	4	806	12/01/84	510	532	0.99	370	565	564	0.95	735	2.21
YL093	565	SIMENTAL	ANGUS	7	738	11/30/84	475	435	0.92	371	570	567	0.96	810	3.12
BL118	566	SIMENTAL	LRXANG	4	14	10/21/84	650	593	1.10	411	670	653	1.11	980	4.03
WH028	567	93/BL EYE	ANGUS	6	393	11/30/84	525	552	1.02	371	520	521	0.89	755	3.05
BL206	568	SP SONS	ANGUS	2	38	10/18/84	510	463	0.86	414	590	550	0.95	765	2.27
YL091	569	LIMOUSIN	ANGUS	7	712	12/05/84	520	553	1.03	366	550	550	0.94	835	3.70
YL084	570	LINC/RED	ANGUS	7	821	11/15/84	580	574	1.07	386	610	606	1.03	870	3.38
WH054	571	LINC/RED	ANGUS	4	259	10/15/84	575	519	0.96	417	630	603	1.03	925	3.83
WH067	572	LINC/RED	ANGUS	6	260	12/07/84	500	543	1.01	364	540	540	0.92	730	3.25
YL083	573	LINC/RED	HERFXANG	4	813	11/20/84	580	584	1.08	381	585	585	0.99	785	2.60
BL123	574	LIMOUSIN	ANGUS	6	239	10/16/84	610	549	1.02	416	680	648	1.10	945	3.44
YL003	575	LINC/RED	ANGUS	6	825	10/30/84	575	539	1.00	402	595	584	0.99	840	3.18
YL090	576	LIMOUSIN	ANGUS	6	708	12/15/84	450	436	0.92	356	490	490	0.83	710	2.65
BL201	577	AN100/84	ANGUS	2	577	10/25/84	575	534	0.99	407	630	610	1.04	915	3.70
BL117	578	SIMENTAL	ANGUS	8	294	10/24/84	550	509	0.94	408	595	577	0.98	885	3.77
BL122	579	LIMOUSIN	ANGUS	10	237	10/17/84	630	568	1.05	415	570	570	0.97	910	4.42
BL121	580	LIMOUSIN	ANGUS	11	739	10/19/84	520	472	0.88	413	575	551	0.94	730	2.79
BL202	581	SP SONS	ANGUS	2	542	10/20/84	545	502	0.93	412	630	601	1.02	885	3.31
RD020	582	LINC/RED	ANGUS	8	838	10/10/84	555	481	0.89	422	550	532	0.90	850	4.03
YL082	583	LINC/RED	CHARXANG	4	726	12/01/84	500	522	0.97	370	520	520	0.88	790	3.51
WH022	584	LINC/RED	ANGUS	9	256	10/15/84	630	569	1.05	417	675	649	1.10	940	3.44
BL204	585	SP SONS	ANGUS	2	59	10/15/84	520	468	0.87	417	555	534	0.91	825	3.51
YL009	586	LINC/RED	ANGUS	8	826	10/15/84	595	534	0.99	417	590	576	0.98	820	2.99
RD014	587	LINC/RED	ANGUS	7	841	10/16/84	620	558	1.04	416	635	616	1.05	915	3.64
BK005	588	93/BL EYE	ANGUS	8	390	10/15/84	600	542	1.01	417	645	620	1.05	835	3.25
YL013	589	LINC/RED	ANGUS	6	824	10/08/84	620	544	1.01	424	650	621	1.06	845	2.53
BK006	590	93/BL EYE	ANGUS	8	377	10/17/84	545	481	0.89	415	630	595	1.01	805	2.27
WH026	591	93/BL EYE	ANGUS	7	387	12/01/84	525	554	1.03	370	535	536	0.91		DEAD

TABLE XXVII (Continued)

FDYD FIN WGHT	GAIN /DAY	INDX	CARCASS WGHT	MTR	MRBL	QLTY	YGR	RIB EYE	% KPH	CARCASS VALUE
1087	3.20	0.99	688	A	SM-	C-	3.3	11.9	1.5	577.92
1065	3.05	0.95	674	A	T+	S	2.8	13.3	2.0	404.40
1074	3.25	1.01	680	A	SL-	G-	3.0	14.1	1.0	544.00
			666	A	SM-	C-	3.4	13.0	1.5	559.44
1052	2.96	0.92	666	A	SM	C-	3.4	12.0	1.5	559.44
1111	2.91	0.91	703							590.52
1101	3.29	1.02	697	A	SM-	C-	3.3	12.8	1.5	585.48
905	2.33	0.72	573	A	SL-	G-	2.5	12.0	2.5	458.40
949	2.60	0.81	601							504.84
1156	3.33	1.03	732	A	SM-	C-	3.0	14.5	2.0	614.88
953	2.96	0.92	603	A+	SM-	C-	3.2	12.3	1.5	506.52
949	2.46	0.76	601	A-	SM-	C-	3.0	11.7	2.0	504.84
1057	3.47	1.08	669							561.96
1092	3.30	1.02	691	A	SM-	C-	3.3	13.4	3.0	580.44
1137	3.48	1.08	720	A	MT	C	3.5	13.4	2.0	604.80
992	3.10	0.96	628	A-	SM-	C-	3.0	12.0	2.0	527.52
965	2.60	0.81	611	A+	SM-	C-	3.2	12.2	2.5	513.24
1218	3.68	1.14	771	A	SL+	G+	3.6	13.2	3.0	616.80
1022	2.93	0.91	647							543.48
929	3.01	0.93	588	A	SL+	G+	3.0	13.3	3.0	470.40
1166	3.67	1.14	738							619.92
1107	3.51	1.09	701	A	SM-	C-	3.2	13.8	2.0	588.84
1144	3.93	1.22	724	A	SM-	C-	3.4	13.4	2.5	608.16
1062	3.33	1.04	672	A-	SL=	G+	3.0	13.3	3.0	537.60
1122	3.37	1.05	710	A	SM-	C-	3.9	11.6	2.0	596.40
1082	3.64	1.13	685	A-	SM	C-	3.3	12.2	2.0	575.40
1047	3.61	1.12	663	A	SL+	G+	3.1	12.8	2.0	530.40
1183	3.48	1.08	749							629.16
987	2.96	0.92	625	A	SM	C-	3.0	12.4	1.5	525.00
1024	2.97	0.92	648	A	SM-	C-	3.3	14.2	2.0	544.32
1186	3.78	1.17	751							630.84
1071	2.92	0.91	678	A	SM-	C-	3.5	10.4	2.0	569.52
1071	2.88	0.90	678	A-	SL+	G+	3.2	12.6	1.5	542.40
1051	2.88	0.89	665	A-	SL-	G-	3.2	13.2	0.5	532.00

TABLE XXVIII

OKLAHOMA STEER FEEDOUT: SAMPLE OF ONE PEN ENTRY

SIRE BREED:	HERE	HERE	HERE	HERE	ANGUS	
DAM BREED:	HERE	HERE	HERE	HERE	HERE	
CALF NUMBER	TD46	TD47	TD48	TD49	TD50	AVERAGES
BIRTH DATE	10-15-84	10-12-84	10-20-84	8-15-84	8-20-84	
IN FRAME SCORE	4	4	6	3	2	3
IN WEIGHT 8/7/85	575	655	675	650	630	637
START WEIGHT 8/21/85	610	665	685	680	620	652
WARMUP PERIOD ADG	2.50	0.71	0.71	2.14	-0.71	1.07
SALE DATE: 1-14-86	TOTAL DAY 160	(INCLUDES 14 DAY WARM-UP)				
SALE WEIGHT (FULL)	1120	1165	1200	1150	1095	1146
AVERAGE DAILY GAIN	3.49	3.42	3.53	3.22	3.25	3.38
OUT FRAME SCORE	4	4	5	4	3	4
CARCASS WEIGHT	668	710	730	730	678	703.2
FAT COVER(IN.)	0.60	0.60	0.50	0.60	0.60	0.58
RIB EYE AREA(SQ. IN.)	12.1	12.1	13.2	13.4	12	12.56
KHP FAT(%)	2	3	1	2.5	2	2.1
YIELD GRADE	3.07	3.43	2.50	2.99	3.14	3.02
QUALITY GRADE	C-	C	G	C	C	
PRICE CWT.	96.50	96.50	92.50	96.50	96.50	95.70
VALUE	644.62	685.15	675.25	704.45	654.27	672.75
TOTAL VALUE						3363.74

ITEM:	TOTAL COST	QUANITY
TOTAL FEED & YARDAGE	1168.62	18697
VETERINARIAN COSTS	11.00	
SAMPLE INTEREST COSTS	89.57	
MISC. COSTS	37.07	
TOTAL PEN COSTS	1306.26	
TOTAL COST PER HEAD	261.25	
TOTAL COST PER CWT. GAIN	56.41	
ORIGINAL PEN VALUE	1974.80	62.00per cwt.
NET PROFIT		
PER HEAD	16.54	
TOTAL FOR PEN	82.68	

APPENDIX C

QUALITY GRADE KEY

TABLE XXIX

KEY TO QUALITY GRADE NUMERICAL VALUES

Quality Grade	Dependent Variable Numerical Values
Prime+	12
Prime	11
Prime-	10
Choice+	9
Choice	8
Choice-	7
Good+	6
Good	5
Good-	4
Standard+	3
Standard	2
Standard-	1

APPENDIX D

ADDITIONAL RESULTS FROM REGRESSING PERFORMANCE CRITERIA ON DESCRIPTIVE INFORMATION

TABLE XXX

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING YIELD GRADE ON DESCRIPTIVE INFORMATION: RANCH A DATA[a]

	Estimates, by Equation						
	1	2	3	4	5	6	7
$\bar{R}^2$	.099372	.091759	.093811	.096594	.086314	.089134	.113989
Intercept	3.222	3.224	3.179	3.140	3.123	3.141	3.052
Independent Variables							
Calf Breed							
#1	.3562	.3564	.3546	.3382	.3455	.3413	.3298
#3	.3224	.3223	.3369	.3264	.3171	.3307	.3521
#4	.1066	.1069	.1139	.1059	.1072	.1291	.1931
#5	.2059	.2061	.2277	.2202	.2148	.2078	.2357
ln age							
#1		-.0003	.0187	.0207	.0215	.0470	.1506
#2		-.0065	.0101	.0158	.0135	.0387	.0795
ln weight							
#1			.0618	.0835	.0719	.0414	.0889
#3			.0505	.0556	.0505	.0855	.0205
#4			.0265	.0270	.0248	.0421	-.0715
#5			.3163	.2994	.2940	.3590	.0530

TABLE XXX (Continued)

	Estimates, by Equation						
	1	2	3	4	5	6	7
Sex #2				.0649	.0637	.0479	.0455
Stocker average daily gain							
#1					.0283	.0276	-.1306
#2					.0385	.0366	-.0252
#4					.0134	.0188	.0528
Weight/day age							
#1						.0316	.1206
#2						-.0877	-.0568
#4						-.0930	-.1826
Weaning weight							
#1							-.0102
#3							.2361
#4							.2568
#5							.5552

[a] 241 Observations

TABLE XXXI

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING FEEDLOT AVERAGE DAILY GAIN ON DESCRIPTIVE INFORMATION: RANCH A DATA[a]

	Estimates, by Equation						
	1	2	3	4	5	6	7
$\bar{R}^2$	.074462	.076594	.070032	.209023	.216677	.212254	.207833
Intercept	3.050	3.115	3.158	2.925	2.856	2.922	2.888
<u>Independent Variables</u>							
Calf Breed							
#1	-.1893	-.1818	-.1559	-.2505	-.2454	-.2538	-.2497
#3	-.0330	-.0324	-.0354	-.1081	-.1664	-.1640	-.1481
#4	-.4497	-.4421	-.4330	-.4895	-.4993	-.5173	-.4710
#5	-.3758	-.3920	-.4030	-.4527	-.4651	-.4393	-.4239
ln age							
#1		-.0819	-.0921	-.0855	-.0720	-.1146	-.0274
#2		-.1311	-.1421	-.1064	-.1091	-.1316	-.0990
ln weight							
#1			-.1095	.0213	-.0189	.0289	.0640
#3			-.0961	-.0720	-.0861	-.1178	-.1621
#4			-.0574	-.0650	-.0802	-.1206	-.2124
#5			.1177	-.0002	.0157	-.0115	-.2723

TABLE XXXI (Continued)

	Estimates, by Equation						
	1	2	3	4	5	6	7
Sex #2				.4125	.3915	.3934	.3930
Stocker average daily gain							
#1					.1723	.1767	.0480
#2					.0797	.0867	.0313
#4					.1888	.1906	.2228
Weight/day age							
#1						-.1411	-.0587
#2						-.0284	.0040
#4						-.0397	-.0897
Weaning weight							
#1							-.0792
#3							.0831
#4							.2113
#5							.3962

[a]246 Observations

TABLE XXXII

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING FINISHED WEIGHT ON DESCRIPTIVE INFORMATION: RANCH A DATA[a]

	Estimates, by Equation						
	1	2	3	4	5	6	7
$\bar{R}^2$	.090177	.133618	.230740	.517047	.522032	.531638	.533409
Intercept	1091	1136	1098	1019	1006	1046	1031
<u>Independent Variables</u>							
Calf Breed							
#1	-15.70	-12.50	-1.98	-34.31	-34.85	-38.17	-37.08
#3	-18.59	-17.12	7.92	-16.92	-27.59	-24.60	-18.29
#4	-122.60	-118.93	-76.09	-95.40	-97.91	-100.26	-79.61
#5	-99.12	-113.65	-78.01	-94.96	-96.94	-85.05	-78.10
ln age							
#1		-65.05	-31.00	-28.77	-27.10	-62.60	-25.24
#2		-50.94	-37.31	-25.09	-25.65	-38.78	-24.73
ln weight							
#1			-94.29	-49.64	-55.84	-29.91	-13.81
#3			21.01	29.24	26.81	5.19	-15.20
#4			72.82	70.21	66.88	30.07	-10.65
#5			170.15	129.92	132.77	87.54	-22.31

TABLE XXXII (Continued)

	Estimates, by Equation						
	1	2	3	4	5	6	7
Sex #2				140.83	137.47	135.07	134.63
Stocker average daily gain							
#1					30.07	33.77	-22.24
#2					15.02	16.55	-7.39
#4					41.02	41.26	55.52
Weight/day age							
#1						-64.43	-29.41
#2						-23.47	-9.88
#4						17.40	-4.61
Weaning weight							
#1							-33.20
#3							41.03
#4							91.66
#5							169.33

[a]246 Observations

TABLE XXXIII

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING FEEDLOT GAIN ON DESCRIPTIVE INFORMATION: RANCH A DATA[a]

	Estimates, by Equation						
	1	2	3	4	5	6	7
$\bar{R}^2$	.042487	.045908	.049110	.425079	.431509	.428505	.426730
Intercept	542.93	557.23	564.89	485.75	473.23	484.46	477.30
Independent Variables							
Calf Breed							
#1	-20.76	-19.14	-12.33	-44.49	-43.17	-44.55	-43.85
#3	3.85	4.00	5.41	-19.31	-29.88	-29.58	-26.17
#4	-77.78	-76.12	-68.82	-88.04	-89.61	-92.78	-84.59
#5	-61.49	-65.12	-64.49	-81.36	-83.70	-79.23	-76.33
ln age							
#1		-18.27	-17.14	-14.93	-12.31	-20.50	-4.30
#2		-28.47	-29.97	-17.82	-18.33	-22.60	-16.58
ln weight							
#1			-42.33	2.09	-5.51	3.24	9.00
#3			-20.43	-12.25	-14.87	-21.00	-28.51
#4			-9.19	-11.80	-14.43	-22.20	-38.38
#5			40.97	0.94	3.73	-2.94	-53.44

TABLE XXXIII (Continued)

	Estimates, by Equation 1	2	3	4	5	6	7
Sex #2				140.12	136.25	136.69	136.65
Stocker average daily gain							
#1					31.55	32.29	8.95
#2					14.69	15.86	5.91
#4					32.67	32.88	38.27
Weight/day age							
#1						-24.54	-9.26
#2						-4.03	2.00
#4						-4.29	-14.10
Weaning weight							
#1							-12.43
#3							15.79
#4							38.52
#5							77.55

[a]265 Observations

TABLE XXXIV

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING CARCASS WEIGHT ON DESCRIPTIVE INFORMATION: RANCH A DATA[a]

	Estimates, by Equation						
	1	2	3	4	5	6	7
$\bar{R}^2$	.100626	.145938	.243177	.478047	.483636	.493968	.517820
Intercept	713.67	738.46	714.15	668.71	660.26	686.18	676.24
<u>Independent Variables</u>							
Calf Breed							
#1	-12.59	-10.57	-4.05	-22.52	-22.92	-25.09	-24.35
#3	-13.90	-12.93	3.07	-11.13	-18.16	-16.17	-11.97
#4	-80.67	-78.35	-51.32	-62.36	-64.04	-65.50	-51.94
#5	-65.76	-75.15	-52.36	-62.04	-63.35	-55.57	-51.00
ln age							
#1		-41.93	-20.22	-18.95	-17.90	-41.22	-16.63
#2		-32.00	-23.21	-16.23	-16.61	-25.19	-15.95
ln weight							
#1			-57.90	-32.39	-36.44	-19.48	-8.93
#3			14.13	18.83	17.23	3.07	-10.31
#4			47.29	45.80	43.58	19.38	-7.42
#5			107.43	84.44	86.27	56.53	15.82

TABLE XXXIV (Continued)

	Estimates, by Equation						
	1	2	3	4	5	6	7
Sex #2				80.46	78.28	76.66	76.39
Stocker average daily gain							
#1					19.75	22.18	-14.67
#2					10.06	11.05	-4.70
#4					27.29	27.45	36.81
Weight/day age							
#1						-42.14	-19.07
#2						-15.56	-6.61
#4						11.51	-2.95
Weaning weight							
#1							-21.80
#3							26.85
#4							60.42
#5							111.45

[a]246 Observations

TABLE XXXV

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING YIELD GRADE ON DESCRIPTIVE INFORMATION: RANCH B DATA[a]

	Estimates, by Equation					
	1	2	3	4	5	6
$\bar{R}^2$	.012431	.097302	.005214	.134804	.110164	.086916
Intercept	3.30	3.44	3.43	3.19	3.17	3.12
<u>Independent Variables</u>						
Sire Breed						
#1	-.0521	-.0691	-.0554	-.2964	-.3369	-.3316
#2	-.1791	-.1410	-.1221	-.0854	-.1012	-.0794
#4	-.1021	-.0540	-.0510	.0099	.0216	.0553
ln age						
#2		-.2258	-.1810	-.0270	-.0452	.0056
#4		-.1559	-.1708	-.0272	.0041	.0238
ln weight						
#1			-.3119	-.3603	-.2385	-.2333
#2			-.0439	-.1383	-.0594	-.0697
#4			-.0519	.0540	.0632	.0388
#5			.0829	.1942	.1907	.1033
Sex #1				.3766	.4282	.4444

TABLE XXXV (Continued)

	Estimates, by Equation					
	1	2	3	4	5	6
Weight/day age						
#1					-.2601	-.2290
#2					-.0173	.0137
#3					-.0198	-.0089
Weaning weight						
#1						-.0720
#3						-.0314
#4						.1154

[a]72 Observations

TABLE XXXVI

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING FEEDLOT AVERAGE DAILY GAIN ON DESCRIPTIVE INFORMATION: RANCH B DATA[a]

	Estimates, by Equation					
	1	2	3	4	5	6
$\bar{R}^2$	.080140	.200597	.177229	.248645	.235814	.228681
Intercept	3.44	3.78	3.79	3.55	3.52	3.46
Independent Variables						
Sire Breed						
#1	-.0333	.0343	.0407	-.0903	-.1140	-.0913
#2	-.1312	-.0255	-.0287	.0179	-.0017	-.0040
#4	-.4404	-.3319	-.2900	-.2240	-.2340	-.2032
ln age						
#1		-.4352	-.4710	-.3214	-.2672	-.2748
#2		-.4561	-.4681	-.3507	-.3408	-.3367
ln weight						
#1			.1480	-.0027	-.0934	-.0699
#2			.0225	-.1213	-.1473	-.0834
#4			-.0463	.0282	.0643	.0369
#5			.0807	.1942	.2175	.2316

TABLE XXXVI (Continued)

	Estimates, by Equation 1	2	3	4	5	6
Sex #1				.3430	.3049	.2756
Weight/day age						
#1					.1255	.1440
#2					.0961	.0771
#3					-.0600	-.0771
Weaning weight						
#1						.1037
#3						.1516
#4						.2949

[a]95 Observations

TABLE XXXVII

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING FINISHED WEIGHT ON DESCRIPTIVE INFORMATION: RANCH B DATA[a]

	Estimates, by Equation					
	1	2	3	4	5	6
$\bar{R}^2$	.021817	.204890	.553718	.548636	.558693	.556048
Intercept	1074	1142	1125	1123	1160	1134
<u>Independent Variables</u>						
Sire Breed						
#1	-48.76	-35.11	-13.46	-14.64	-18.20	-10.85
#2	-3.42	24.89	-2.32	-1.91	-2.58	1.80
#4	-33.37	-11.56	-43.22	-42.63	-32.26	-15.18
ln age						
#1		-122.78	-75.41	-74.07	-93.60	-84.99
#2		-75.49	-65.88	-64.83	-68.59	-63.49
ln weight						
#1			-101.61	-102.96	-77.23	-66.18
#2			-62.27	-63.56	-42.47	-28.68
#4			45.36	46.03	23.89	11.82
#5			106.66	107.68	75.82	63.79
Sex #1				3.07	11.27	8.78

TABLE XXXVII (Continued)

	Estimates, by Equation					
	1	2	3	4	5	6
Weight/day age						
#1					-69.60	-60.71
#2					-42.38	-42.51
#3					-43.75	-44.92
Weaning weight						
#1						6.28
#3						32.67
#4						31.24

[a]95 Observations

TABLE XXXVIII

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING FEEDLOT GAIN ON DESCRIPTIVE INFORMATION: RANCH B DATA[a]

	Estimates, by Equation					
	1	2	3	4	5	6
$\bar{R}^2$	.057779	.164644	.141142	.154875	.141320	.131252
Intercept	491.16	534.88	534.02	516.70	512.20	503.53
<u>Independent Variables</u>						
Sire Breed						
#1	-14.88	-6.21	-2.52	-12.05	-15.50	-12.27
#2	-10.91	2.90	-0.96	2.44	-0.43	-0.59
#4	-52.86	-38.95	-37.61	-32.81	-34.29	-29.74
ln age						
#1		-57.10	-56.15	-45.26	-37.28	-38.02
#2		-57.86	-57.90	-49.34	-47.89	-47.24
ln weight						
#1			9.91	-1.06	-14.40	-10.66
#2			-6.50	-16.98	-20.85	-11.94
#4			-1.22	4.21	9.55	5.60
#5			20.66	28.92	32.41	34.07
Sex #1				24.97	19.38	15.35

TABLE XXXVIII (Continued)

	Estimates, by Equation					
	1	2	3	4	5	6
Weight/day age						
#1					18.56	21.28
#2					14.17	11.69
#3					-8.66	-10.92
Weaning weight						
#1						13.40
#3						21.07
#4						4.62

[a]95 Observations

TABLE XXXIX

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING CARCASS WEIGHT ON DESCRIPTIVE INFORMATION: RANCH B DATA[a]

	Estimates, by Equation					
	1	2	3	4	5	6
$\bar{R}^2$	.025888	.232586	.508872	.533726	.533726	.531492
Intercept	687	734	725	712	736	719
<u>Independent Variables</u>						
Sire Breed						
#1	-23.84	-14.43	-2.71	-9.93	-12.31	-7.71
#2	-8.50	9.69	-5.73	-3.16	-2.30	1.38
#4	-28.61	-13.56	-30.32	-26.68	-20.13	-10.32
ln age						
#1		-81.63	-55.18	-46.92	-60.03	-54.84
#2		-53.50	-48.45	-41.97	-44.26	-40.99
ln weight						
#1			-58.04	-66.36	-49.54	-43.22
#2			-33.53	-41.46	-27.38	-19.12
#4			23.97	28.08	14.45	8.41
#5			62.25	68.51	47.41	41.17
Sex #1				18.92	24.24	22.47

TABLE XXXIX (Continued)

	Estimates, by Equation					
	1	2	3	4	5	6
Weight/day age						
#1					-45.51	-38.58
#2					-27.46	-26.41
#3					-28.71	-27.90
Weaning weight						
#1						4.20
#3						20.21
#4						18.61

[a]96 Observations

TABLE XL

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING YIELD GRADE ON DESCRIPTIVE INFORMATION: OKLAHOMA STEER FEEDOUT DATA[a]

	Estimates, by Equation				
	1	2	3	4	5
$\bar{R}^2$	.076567	.065024	.050480	.065148	.234879
Intercept	2.87	2.82	2.88	2.85	2.25
Independent Variables					
Sire Breed					
#1	-.3543	-.3687	-.4576	-.3544	-.3475
#2	-.0497	-.1088	-.1114	.0726	.2655
#3	-.5456	-.6622	-.7188	-.6650	-.0902
#4	-.5223	-.6602	-.7257	-.5572	.2454
#6	-.1453	-.2415	-.3454	-.2567	-.0633
Frame 3		-.0124	-.0287	.1098	-.0843
Frame 5		.2045	.2112	.0952	.0088
Frame 6		-.1337	.2760	.1032	-.1092
Birth month					
February			.3829	.4314	.1022
April			-.2396	-.0967	-.0146
September			-.0224	-.2833	-.5107
October			.3442	.2700	.3065
November			-.1864	-.2467	.1481
In weight					
#1				-.3151	.0640
#2				-.0572	.2147
#3				.3357	.4270
#5				.0744	.1277
#6				.3602	.2899
Owner					
#2					.8861
#3					.8692
#4					.1557
#5					-.1357
#6					.5594

[a]88 Observations

TABLE XLI

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING FEEDLOT AVERAGE DAILY GAIN ON DESCRIPTIVE INFORMATION: OKLAHOMA STEER FEEDOUT DATA[a]

	Estimates, by Equation				
	1	2	3	4	5
$\bar{R}^2$	.126656	.082258	.158070	.190803	.266160
Intercept	3.1108	3.0967	3.0366	3.2290	3.0031
<u>Independent Variables</u>					
Sire Breed					
#1	.4062	.4005	.3221	.3051	.2271
#2	.1006	.0788	-.0452	.1344	.1810
#3	.1170	.0677	.0729	.0634	.7314
#4	.5272	.4929	.1634	.3134	1.0069
#6	.2892	.2353	.3445	.2611	.5787
Frame 3		.0434	-.1961	-.2545	-.3004
Frame 5		.0330	.0041	-.1560	-.1352
Frame 6		.1096	-.0421	-.2440	-.3981
Birth month					
February			-.3151	-.3584	-.5155
April			.3828	.5326	.8491
September			.4431	.1871	.1264
October			.3852	.1866	-.2632
November			.1016	.1645	.1427
In weight					
#1				-.4531	-.1637
#2				-.2586	-.0157
#3				.0210	.1015
#5				.1300	.2121
#6				.0502	.0829
Owner					
#2					.1974
#3					.2705
#4					-.4452
#5					-.8862
#6					.6576

[a]98 Observations

TABLE XLII

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING FINISHED WEIGHT ON DESCRIPTIVE INFORMATION: OKLAHOMA STEER FEEDOUT DATA[a]

	Estimates, by Equation				
	1	2	3	4	5
$\bar{R}^2$	.338621	.372119	.442208	.706533	.723691
Intercept	1068	1052	1023	1145	1090
Independent Variables					
Sire Breed					
#1	92.02	85.69	71.17	35.89	31.58
#2	3.87	-19.47	-25.09	24.83	25.26
#3	97.22	51.29	71.24	46.30	135.23
#4	238.67	191.85	129.53	164.11	219.88
#6	159.67	111.80	146.81	73.70	102.03
Frame 3		11.88	-32.49	-34.82	-39.46
Frame 5		58.79	52.19	-23.39	-19.45
Frame 6		81.90	65.08	-27.20	-48.11
Birth month					
February			-12.40	-54.46	-87.81
April			45.87	119.79	133.41
September			99.51	-86.03	-89.38
October			137.51	17.53	1.96
November			48.21	70.82	76.92
In weight					
#1				-204.57	-154.48
#2				-143.24	-85.21
#3				-51.56	-27.40
#5				83.43	86.61
#6				123.82	124.31
Owner					
#2					21.11
#3					60.10
#4					2.56
#5					-132.37
#6					69.59

[a]98 Observations

TABLE XLIII

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING FEEDLOT GAIN ON DESCRIPTIVE INFORMATION: OKLAHOMA STEER FEEDOUT DATA[a]

	Estimates, by Equation				
	1	2	3	4	5
$\bar{R}^2$	.120449	.232003	.395257	.444871	.468364
Intercept	512.69	518.96	490.35	526.68	477.35
Independent Variables					
Sire Breed					
#1	22.91	16.85	40.15	29.91	21.81
#2	-2.83	-13.92	5.16	22.89	19.43
#3	68.97	28.61	47.14	38.82	119.03
#4	90.31	58.64	141.27	153.75	207.74
#6	81.31	38.35	91.78	65.64	91.41
Frame 3		-82.39	-38.76	-45.94	-48.17
Frame 5		16.75	3.59	-21.54	-16.98
Frame 6		59.98	-0.40	-29.80	-48.60
Birth month					
February			-40.72	-57.46	-82.18
April			106.39	129.23	144.39
September			-31.42	-88.08	-93.26
October			62.11	11.08	-13.91
November			64.58	70.98	70.85
In weight					
#1				-63.13	-13.18
#2				-47.42	9.82
#3				-2.35	21.69
#5				41.68	46.58
#6				28.62	32.60
Owner					
#2					4.91
#3					55.20
#4					-3.73
#5					-125.26
#6					74.48

[a]98 Observations

TABLE XLIV

ADJUSTED R^2, INTERCEPT, AND COEFFICIENTS ESTIMATED IN EACH EQUATION WHEN REGRESSING CARCASS WEIGHT ON DESCRIPTIVE INFORMATION: OKLAHOMA STEER FEEDOUT DATA[a]

	-Estimates, by Equation-				
	1	2	3	4	5
$\bar{R}^2$	.324849	.384355	.428879	.665720	.671501
Intercept	648.69	641.43	630.09	703.63	673.49
<u>Independent Variables</u>					
Sire Breed					
#1	57.11	52.02	42.78	23.58	15.72
#2	8.11	-7.40	-7.29	28.95	22.53
#3	52.09	17.39	29.93	16.29	53.44
#4	144.71	109.45	101.80	128.18	144.23
#6	113.61	77.61	97.33	54.16	64.51
Frame 3		-22.12	-30.57	-39.63	-41.06
Frame 5		39.40	32.49	-14.27	-13.33
Frame 6		55.02	37.33	-19.57	-33.49
Birth month					
February			-41.30	-65.65	-79.67
April			32.21	76.94	78.35
September			28.05	-75.75	-75.28
October			99.80	26.60	-2.30
November			23.92	38.94	35.51
In weight					
#1				-129.66	-98.33
#2				-88.02	-50.12
#3				-27.03	-8.78
#5				50.05	49.24
#6				54.42	56.47
Owner					
#2					-1.63
#3					34.54
#4					14.74
#5					-61.21
#6					67.07

[a]98 Observations

VITA 2

Mary Katherine Hawk

Candidate for the Degree of

Master of Science

Thesis: IDENTIFYING AND PREDICTING PERFORMANCE FOR STOCKER AND FEEDER CATTLE

Major Field: Agricultural Economics

Biographical:

Personal Data: Born in Blountville, Tennessee, May 3, 1961, the daughter of J. Powell and Dorothy D. Hawk

Education: Graduated from Sullivan Central High School, Blountville, Tennessee, in June, 1979; received Bachelor of Science Degree from The University of Tennessee with majors in Agricultural Economics and Animal Science in June, 1984; completed requirements for the Master of Science degree at Oklahoma State University in December, 1987.

Professional Experience: Intern, Production Credit Association, Gallatin, Tennessee, June, 1982 to September, 1982; Trainee, Tennessee Cooperative Extension Service, Sullivan County, Blountville, Tennessee, June, 1984 to September, 1984; Research Assistant, Department of Agricultural Economics, Oklahoma State University, January, 1985 to January, 1987.