THE ELECTRONIC RANCH: THE INFORMATION

ENVIRONMENT OF CATTLE BREEDERS

DISSERTATION

Presented to the Graduate Council of the

University of North Texas in Partial

Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

Jane Hicks, B.A., B.B.A., M.B.A.

Denton, Texas

May 1999

Hicks, Georgia Jane, <u>The electronic ranch: The information environment of cattle breeders</u>. Doctor of Philosophy (Information Science), May 1999, 175 pages, 27 tables, references, 93 titles.

The present study was a longitudinal analysis of the information needs of Red Angus cattle breeders and their use of networked information services. It was based on two surveys. The first, conducted in 1995-96, polled all 1067 ranches of the Red Angus Association of America. Responses from 192 Red Angus breeders were used to determine the value of different information types and to evaluate perceptions of the greatest barriers to the adoption of network information services. The second survey, mailed to 41 Red Angus breeders in 1998, focused on early adopters and likely users of network services. Responses from 15 breeders were used to evaluate perceptions of the greatest barriers to the effective use of Web-based information services.

Five research questions were explored. These questions related to the business information needs of Red Angus breeders, their use of information technology, the business impact of network use, and perceived barriers to network adoption and use.

Results from the two surveys were analyzed using qualitative methods and a variety of descriptive and inferential statistics, with findings summarized as follows:

- The most valuable types of information were market-related.

- Personal sources of information were more valuable than nonpersonal sources.

- Desire for networked access to specific information was strongly related to the

perceived value of the information.

- Primary barriers to adoption of computer network technology were the opportunity costs of time and money. Primary factors that could have encouraged adoption were training and local access to Internet service providers.

- Cattle breeders' perception of the importance of networked services was unrelated to their level of experience using these services.

- Network use at a location other than the ranch was unrelated to the adoption of networks at the ranch.

- There was no significant change in total time spent using networked services between 1995 and 1998.

- Problems that users reported with using the Web paralleled the findings of large surveys of general Web users.

THE ELECTRONIC RANCH: THE INFORMATION

ENVIRONMENT OF CATTLE BREEDERS

DISSERTATION

Presented to the Graduate Council of the

University of North Texas in Partial

Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

Jane Hicks, B.A., B.B.A., M.B.A.

Denton, Texas

May 1999

ACKNOWLEDGMENTS

I wish to thank Dr. Judy Bateman for her support throughout the dissertation process. Judy graciously mentored many of my fellow students and she extended her generosity and wisdom to me in particular. Judy's continues to befriend me in many ways for which I am truly grateful.

I sincerely thank Terry Sullivan for sharing his encyclopedic knowledge and technological expertise with me.

I wish also to thank the members of my dissertation committee: Dr. Donald Cleveland, Dr. Earl McCallon, Dr. Amanda Spink and Dr. Jon Young. Their advice and counsel is deeply appreciated.

.

TABLE OF CONTENTS

Introduction
        Definition of Terms
Statement of the Problem
Purpose of the Study
Research Approach
        Research Questions
        Research Methods
Significance of the Study
Background
        The Red Angus Association of America (RAAA)
Assumptions and Limitations
 Summary

Information Needs
        Information Use Environments of Managers
        Problem-solving
        Planning
        Decision-making
The Information Environment of Ranchers
        Intentional Action
Putting User Needs and the Context Together
Diffusion of Innovation to Rural Communities
        Technology Diffusion
Adoption of Information Technology by the Ranching Community
Specification of Business Problems of Cattle Breeders
Conclusion

LIST OF TABLES

CHAPTER 1

PROBLEM STATEMENT

Introduction

The present study examined the perceptions, use and potential use of electronic

information services by cattle ranchers. It presents the results of two user surveys

intended to identify the information types and sources of greatest value to these users, and

to identify barriers to both adoption and use of networked information services. The

context of the study was the information use environment of ranch managers which

touches upon question of information technology adoption, business decision-making,

and Web usability.

Initial survey results were gathered in 1995 by the Red Angus Association of

America during the planning phase of providing a Web gateway to the information

services they provide. In 1998, Red Angus members who were interested in networked

services at the time of the first survey were asked about the advantages and barriers they

perceive in using networked information services.

Breeders of Red Angus cattle were opportune subjects for this study. They

represent a community with shared information needs and a shared need to overcome

isolation. The need to overcome distance to reduce "windshield time" and to compete in

wider markets makes the business problems of cattle breeders feasible to address with

networked information services. Another reason to consider the contribution information services may make in solving problems of cattle breeders is that they represent a distinct worldwide market to cross-breeders and suppliers.

Along with artificial insemination, the growing acceptance of using embryos for cattle breeding has increased international trade. Because they are both rural and increasingly international, cattle breeders are a community of special interest to networked information studies.

Definition of Terms

Terms used in this study were defined based on shared meanings in the literature of business and information science.

Network refers to the telecommunications infrastructure that supports external, public computer-mediated communication including the Internet and the Web. The World Wide Web, (WWW or Web) is defined as that portion of the Internet that runs on the hypertext transfer protocol and that has multimedia capabilities. Private and local area networks were not considered because they are not a significant presence for this user population.

Computer networks refer to computers that are linked to each other through the telecommunications network.

(Networked or electronic) information services are defined as information sources accessible via computer networks.

(Electronic) information technology is defined as the computer and

telecommunications hardware and software necessary to support computer network access.

Information systems are defined as the information technology of both users (client-side hardware and software) and information services (server side technology and product).

Business information needs are defined as information required for business planning, decision-making and problem solving.

Statement of the Problem

Access to electronic information is increasingly important to businesses. Spurred by the growth of the Web, networked information has increased the competitiveness, speed, and scope of business transactions. However, the development of effective information services depends upon in-depth knowledge of user requirements. To date, little research has been done on the information needs of ranch workers and networked information for the ranching industry. The lack of empirical data hampers the design of information services for this population, particularly as regards Web-enabled systems and the increased opportunities they offer rural businesses. Technology transfer and diffusion of innovation research, conducted primarily by researchers in the field of rural sociology, relates to information needs and services. Agricultural scientists also conduct research that relates to information needs and the use of information technology. There is, however, a definite lack of models to use in conducting interdisciplinary studies related to assessing the information needs of technology users.

Information-intensive problems go much deeper, from the ranchers' point of view. This research addressed ranchers' problems that give rise to the concern, especially among ranch families, of sustaining their way of life. Clayton Yeutter (1995), a former U.S. Secretary of Agriculture, points out that few people outside agriculture recognize how sophisticated and knowledgeable farmers and ranchers must be to be successful. He claims that the knowledge level of present day farmers exceeds that of extension service representatives (agents of county, state, or federal agricultural extension services) who 20 years ago would have been their mentors. He expects this level of technological sophistication to develop during the next decade beyond what is even contemplated today.

Ranchers concerned with survival may suffer from problems of keeping up with technology in general and computer and communications technology in particular. The basis of this research is the information needs of ranchers and the set of problems ranch families face in adopting and using computer-based information technology. Michael Tavoletti, quoted in a Newsweek article (McGuinn & Raymond, 1998), reflects on the problem, "[I'm just] a guy who knows that (computer-based) technology is the key to keeping the farm in the family."

<div style="text-align:center">Purpose of the Study</div>

The purpose of this study was to investigate the role of the Web and other networked information services in meeting the business information needs of cattle breeders. This research was conducted in partnership with an information services provider, the Red

Angus Association of America (RAAA), as part of their strategic plan to provide Web access to the information they collect and process. The purpose of the research was to discover RAAA members' information needs, the value to them of networked access, and barriers to access and use.

The purpose of the initial survey of information needs and network use was, in part, to establish a set of user requirements for networked services. The purpose of the Association's Web site is to provide online access to their library of sire directories to allow users to search, query and get reports of the expected progeny difference statistics (EPDs) of all registered Red Angus bulls and to provide an electronic newsletter and journal. The RAAA's eventual purpose for their Web site is to include links to information that address business problems and opportunities of Red Angus breeders and to provide an online marketplace for Red Angus cattle, embryos, and semen. Plans for further development include an interactive trading post, with a bulletin board and a searchable multimedia database of sire prospects that includes statistics for each bull, and video clips that provide what many buyers consider essential information by showing the gait and something of the temperament of the animal. The RAAA plans to offer multimedia databases, depending upon the availability of network support for interactive images and text.

As the first step in the long-range plan, the RAAA's goal was to reach a clear understanding of user needs and preferences. The RAAA as system provider was uncertain which resources are most valued by member users, what barriers exist for

network use or access, and of the value of their prospective offering of networked

information services. Users may not know what is available on the Web (or what could

be made available) and may be unsure of the value to their business of networked

information. This study sought to reduce these uncertainties by providing the RAAA

with a set of specific user requirements based on initial survey data, and with results of a

second, follow-up survey of Red Angus members about their experience in using

networked services.

A corollary purpose for this study was to apply research in the information

sciences to the design of information technology to meet the information needs of rural,

geographically dispersed groups with shared information needs. An aspect of this

purpose was to present an interdisciplinary model that uses communication theories as a

basis to extend models of information seeking and use to the business context of

planning, problem solving, and decision-making. An outcome of this goal was an

interdisciplinary model of management information use.

Research Approach

Understanding user needs was the conceptual, theoretical aspect of this research.

Assessing user needs was the methodological aspect of this research. These aspects are

closely related and, ideally, each process should inform the other. The distinction made

here was for scholarly purposes. Understanding user needs was approached with

theories of intentional action. Methods for assessing needs in order to specify user

requirements for information system design draw on theories of problems associated with

specific information use environments. Intentional action theories, used as the basis for understanding user needs, and problems-based theories, used as the basis for assessing user needs, were both represented with traditional management models.

Communication scholars have written extensively about needs as arising from desire and intention (Goldman, 1992). Information science scholars also discuss information needs as arising from the desire to reduce uncertainty (Belkin, 1980) and to make sense of things (Dervin, 1983). Information needs may also arise from the information use environment (Taylor, 1986b). Information needs and uses (Dervin & Nilan, 1986) are discussed in terms of gaps in a user's knowledge that the user attempts to bridge by seeking additional information. Information needs are also discussed as producing intentional action expressed in the context of solving problems (Wersig & Windel, 1985). For the purposes of this research, ranchers' business information needs were addressed as arising from the desire to solve business problems and make long-range plans.

Communication theories of intentional action (e.g., Goldman, 1992), lend themselves to representation with the traditional management model of the business planning cycle. The management planning model can be used to establish a framework for the two elements of this research project, that is, for both the theory of understanding user needs and the problems-based methods of assessing user needs. For example, the model was used to frame the discussion of ranchers' long-range planning, business problems and related information needs. The traditional business planning cycle is

defined as the imperative to find a mission, develop strategies, set goals, make action plans, take action, and evaluate effectiveness. To relate the terminology used in intention theory to the planning model, mission and goals addresses the questions: "What do we value?" and "What do we want to accomplish?" An organization's strategies address intention at a greater level of detail: "How can we intend to reach our goals?" Action plans answer the question "What will we do?" Evaluations answer the questions: "What actions have taken place?" and "Are we living up to our mission?" The relationships among these terms are represented in Table 2-1, used to establish an interdisciplinary context for the present study.

The information needs of cattle breeders and methods for assessing information needs were approached in the context of business problem solving. Based on the researcher's understanding of the business problems and opportunities of the end-users and the information provider (the RAAA), a set of questions was developed to include on the initial survey about information needs. The set of business information needs identified in the first survey was used to develop questions for the follow-up survey. The subjects for the follow-up survey were Red Angus breeders who had cleared the equipment and most of the access barriers to adopting information technology at the time of the first survey, and who were using networked information services or who had stated their intention to do so.

The problem-based approach to assessing information needs of prospective users theorizes that needs can be obtained from the user's situation (MacMullin & Taylor,

1984). The user's situation is represented by problems that may either be sought out or imposed. The problems ranchers face are considered to take on the full range of dimensions as outlined by MacMullin and Taylor, from the familiar and goal-directed problem of forecasting the weather, to the complex and amorphous problem of competing in an increasingly global arena.

Research Questions

Established models of planning and decision making from the field of business and models of information seeking and use from the field of information science were both related to an established model of intentional action from the field of communication. This was done to provide a theoretically sound basis for the interdisciplinary approach needed to complete the present research. These interrelated models of intentional action were then related to a proposed management information model. The management information model was used to identify the following research questions.

1) What are the business information needs of Red Angus cattle breeders?

2) What information technology do they use?

3) What barriers do cattle breeders perceive to adopting computer network information technology?

4) What barriers do cattle breeders perceive to using computer networks?

5) What business advantages and disadvantages do cattle breeders perceive in using networked information services?

These research questions gave rise to the research design decision to use interviews and surveys. Interviews with the industry partner were used to establish the information use environment of Red Angus breeders, including the nature of their market, their business problems and business opportunities. This context was used to identify information needs arising from specified problems and opportunities. Survey questions regarding specified information needs and the use of networked information services were used to elicit answers from breeders to address the five research questions.

Research Methods

Ranchers' information needs are considered in the context of ranch management. This context is determined by reviewing literature about the cattle industry and by studying the agricultural statistics of the U. S. Bureau of the Census and the Department of Agriculture. The business context of ranching is further established by interviewing the industry partner, the Red Angus Association of America (RAAA). The business problems and opportunities of ranchers are investigated as a basis for identifying potential information needs. The types of information needs that arise from specified problems and related sources of information available via network are then specified in the form of survey questions.

Surveys were sent to all Red Angus member breeders in 1995. This procedure ensured that all members of the population had an equal chance of being included in the survey, in hopes of making the survey sample as representative as possible of the larger population of Red Angus breeders. The initial survey was designed to answer research

questions 1-3. A complete copy of this survey is shown at Appendix B. A second survey was conducted in 1998, focusing on a smaller group of Red Angus breeders who in 1995 were using networked services or who intended to become network users. The second survey is designed to answer research questions 4 and 5. The second survey is shown at Appendix D.

Barriers to implementing and using networked information systems and services are considered to be a particularly relevant set of problems for ranch owners in the context of the present research. This problem was segregated from other business planning problems in the initial survey of all members by asking an open ended question about their problems of implementing the computer and communications technology needed to support networked information access. In the second survey, users were asked about problems they encountered accessing networked information.

The corollary to the separate question about barriers is a second open-ended question on the first survey about the advantages of adopting networked information technology. In the second survey, users were asked about the advantages of using networked information services.

The business model used as a theoretical basis for emphasizing this question is based on consideration of opportunities (advantages) as well as problems (barriers) associated with adopting and using network technology. The number of variables considered in analyzing farmers' adoption of new agricultural technology has steadily grown during the 1970s and 1980s (Doorman, 1991). These variables include norms and

values, belief systems, formal and informal leadership and organization, and vertical and horizontal social relations. These interrelated, complex variables support the use of open-ended questions about both advantages and barriers to new agricultural technology, because an implicit assumption in this work is that the net cost (barriers) or benefit (advantages) to the farm or ranch enterprise as a whole is an important variable in deciding to adopt and use new technology.

Significance of the Study

This study deals with understanding user problems and information needs as a precursor to specifying user requirements during system conceptualization. A clear understanding of user requirements is a necessary condition for users satisfaction with resulting systems (Martin, 1985). Support for the validity of this claim extends through the system design and evaluation literature of the past two decades. This research proposes that the best way for system designers to specify the requirements of users is to understand the user problems that give rise to user needs. Users' problems can be conceptualized as facing an individual, an enterprise, or, as in the case of this research, an association of private ranching enterprises.

This study identifies the information needs of current and potential network users among cattle breeders and adds to the discussion of information transfer to rural areas. This study can be used as a model for the initial assessment of the information needs of other rural businesses.

This research is a necessary precursor to quantifying the potential economic

benefit of information technology for Red Angus cattle breeders and can be generalized

to the cattle breeding community as a whole. As such, it may be of interest to information

service providers, such as the United States Department of Agriculture (USDA), the

Rural Information Center, and federal, state and county agricultural extension services.

This research is also of potential interest to network providers. More sophisticated

telecommunications networks are widely considered to be essential for rural economic

development. Over the past decade, advances in computer networks have increased the

scope of the cattle business by overcoming geographic isolation. The growing

international trading level of this industry may soon make sophisticated information

networks as essential as "plain old telephone service." Results of this research may be

shared with rural public network providers, with niche network providers such as satellite

auctioneers, and with networked marketing services, such as Pell Cattle Marketing and

Consulting Company's Web-accessible system for artificial insemination trades and cattle

sales.

The significance of adopting and using networked information technology is

summarized in the following statement, written for an audience of ranchers, for use by the

researcher as a working draft for discussing assumptions with Red Angus Association

representatives. Part of this statement was published in the *American Red Angus*, August

1996. The edited press copy is shown at Appendix C. The discussion draft follows:

Why do we and our research partners at the University of North Texas

think computer networks are important to cattle breeders? Computer

networks, like computers in general, can be frustrating to use. But they offer a financial edge to both large and small operators and may be as easy to use as the telephone in the near future. The spread of telephones affected the lives of rural people everywhere and computer networks may do the same.

Some advantages computer networks offer include access to special-interest information and the ability to broadcast your own messages on the World Wide Web. By putting information about your business on a computer network, potential customers anywhere in the world can read about your operation, see pictures or video clips of your breeding stock, and send electronic mail to you.

Background

The impact of information technology on this segment of the rural economy is important due to the overall importance of the ranching industry. In 1995, the total number of farms was 2.1 million, led by Texas with 202,000 farms. Missouri was a distant second at 106,000. The current definition of a farm by the U.S. Bureau of the Census is any place from which $1,000 or more of agricultural products (crops or animals) are produced and sold, or normally would have been sold, during the census year. In 1994, agricultural cash receipts were $180 billion, of which cattle and calves was the leading commodity at $36 billion.

Ranching is also important to the national balance of trade. Imported beef

quantities have remained relatively consistent from 2,064 million pounds in 1980 to 2,103 million pounds in 1995. Exports, however, have grown in the same period of time from 173 to 1,821 million pounds (U.S. Bureau of the Census table No. 1113).

The Red Angus breed of cattle has become an increasingly important component of the agricultural sector. The Angus breed originated in the British Isles where recorded reference to the appearance of red cattle dates back to 1805. The first Angus herdbook, published in Scotland in 1862, entered both reds and blacks without distinction. Early in the development of the breed, Hugh Watson of Keilor, Scotland, arbitrarily decided that black was the proper color for the breed - he could just as easily have chosen red. Angus was introduced into the United States in the 1870s and both reds and blacks were registered in the American Angus herdbook until 1917 when reds were barred. Severe discrimination against the reds in order to assure a pure strain of black resulted in a marked decline in the number of red calves born. Red, however, is carried on a recessive gene, and in 1945, cattlemen first started selecting and breeding reds cropped from the best Angus herds in the United States. In 1954 a sufficient number of herds had been established and the breeder organization known as the Red Angus Association of America, was formed (Mason, 1996).

The Red Angus Association of America

This research was conducted with the assistance of an industry research partner, the Red Angus Association of America (the RAAA). The RAAA, headquartered in Denton, Texas, is an association of 1,600 Red Angus cattle breeders from 47 U.S. states and two

Canadian provinces. The mission of the association is to promote and improve the breeding, feeding and marketing of Red Angus cattle (American Red Angus, 1995). This mission requires the Association to maintain and provide access to a computerized registry of Red Angus breeding information, the Red Angus Sire Directory.

The Association is essentially an information service provider. It maintains a computerized registry of Red Angus breeding information that involves capturing, processing, and providing access to data and publishes a monthly trade magazine, the American Red Angus. The Association perceives advantages to making services available electronically for the widely dispersed, rural community of breeders and advantages to providing electronic access to the 5,400 international subscribers to the *American Red Angus* who represent primarily suppliers and buyers. Potential economic benefits of networked information for their members include entry into new markets, knowledge shared among ranchers and breeders through the use of local and national bulletin boards, and increased political leverage through the presence of an electronic ranching community.

The greatest potential benefit to the Association itself of Web-accessible, searchable information will be to reduce its effort to collect or capture data from members. This will improve the timeliness and accuracy of the breed registry, the maintenance of which is the Association's primary responsibility. This breed registry is regularly published as about a three-inch thick book which, quite understandably, is out of date before it's out in print. The benefits of making this information available for online searching adds a

significant layer of value to the information itself.

Assumptions and Limitations

An assumption of this study is that many of the information demands of cattle breeding can be supplied via computer networks, increasingly so as video becomes viable and electronic cash transactions become secure.

A primary limitation was that respondents to both surveys would be self-selected. It was expected that initial survey respondents would include users who are both the most likely and the least likely to be early adopters of network technology. The expected self-selection of "nay sayers" was not seen as a serious threat to the validity of using survey results to assess information needs and inform Web site design. The expected self-selection of "yea sayers" was not seen as a serious threat to the ability to draw conclusions about perceived barriers to computer network use.

Even if the subjects of this study had clearly thought out long-range plans and had a clear understanding of their business problems, they still may have been unaware of the existence or sources of information that could help solve their business problem or help reach decisions. User information needs and problems are often poorly defined and difficult for users to articulate (Belkin, 1980). This effect of this limitation was reduced by using both open-ended survey questions and check off lists with identified types and sources of information.

This study was designed to be able to generalize the findings to the wider population of breeders of all strains of cattle, for both network users and non-network users. Cattle

breeders are a fairly homogeneous group. All must register cattle with an association, they can be assumed to be roughly as widely scattered over distance as Red Angus is breeders in America and Canada, they can be assumed to be rural, by the nature of their business, and they face a core set of information problems associated with breeding, keeping records and marketing their cattle. Other problems (drought and pests, for example) may vary widely within this population but will vary by location, not by breed. Other findings of the study, such as telecommunications barriers to network access, may be generalized a larger rural population. Findings about user problems with actually using networked information services once they are online were generalized to the larger population of information technology adopters, because patterns in the results reflected patterns in the findings of related literature.

Summary

This research was a longitudinal, qualitative analysis of networked communication in a clearly defined segment of the rural population. The purpose of this research was to assess the information needs Red Angus cattle breeders and their perceptions regarding using networked information services to meet their information needs. Qualitative research methods were preferred to quantitative analysis as a means of discovering the factors that influence network use by ranchers. Ranchers were asked open-ended questions to capture the range and frequency of their personal perceptions of the advantages and barriers to using computer networks. No previous study had collected information need and network use data exclusively from cattle breeders.

CHAPTER 2

REVIEW OF THE LITERATURE AND RELATED RESEARCH

Literature from the fields of communication, business, and information science informs the present study. The chosen research paths relate to information used in the context of managing a business. Red Angus breeders are business managers who needs access to information. Three interrelated aspects of management were considered: planning, decision making and problem solving. Corresponding terms used to describe these aspects of management were abstracted from the literature and used to model the information environment of managers. The model was then used to specify the information use environment of ranchers as a set of problems and information needs.

The essential elements of this research were 1) a set of users defined by their shared business information needs 2) the information context of ranch management, and 3) the systems used to deliver information. In this review, users were discussed in terms of information needs and information actions, context was discussed as the information use environment of managers in general and ranch managers in particular, and systems were discussed only in the broadest terms, as the diffusion of innovation to rural populations and the adoption of information technology.

Information Needs

Much early information science research regarding information needs was conducted from a systems perspective. The primary systems-based research question is one that is still appropriate, namely, what can we make the system do? Information technology has mushroomed in speed, power, and connectivity and does not present the same set of constraints and limitations it has in the past. Systems have also come to be better understood by researchers, hardware engineers and software developers. Now that information systems are more powerful, the design question, though still fascinating, loses some of the mystery now accorded to the user on the other end. Correspondingly, there is a growing body of information science research centered on user needs. Dervin and Nilan (1986), characterize these as the user-values approach, which focuses on perceptions of utility and value of information systems, the sense-making approach to information seeking, and the anomalous states-of-knowledge (ASK) approach, which examines how people seek information concerning situations about which their knowledge is incomplete.

Elizabeth R. Hewins (1990), in reviewing information needs and use studies conducted from 1986 to 1990, concluded that Dervin and Nilan's characterization was still valid and that the research direction is headed toward more studies that emphasize the individual user's cognition rather than studying groups of users. Hewins describes approaches to studying cognitive processes with respect to the user and to system design. These approaches include information seeking, source evaluation, information retrieval, search behavior, source and system use, and information evaluation (p.158). The present study asked users about the value to them of different types and sources of information, and in this respect, according to Hewins designation, is part of the cognitive stream of information research.

The present research is also in the tradition of those studies that examine the characteristics of a group to which the user belongs. The present research de-emphasizes the line of cognition research in the information sciences that began with Robert S. Taylor's (1968) question-negotiating theories for reducing users' uncertainty. This theory was expanded by Brenda Dervin (1983) as the sense-making approach and by Belkin, Oddy, and Brooks (1982) as the ASK (anomalous state of knowledge) model of user cognition.

Rather, the present research emphasizes the sociological line of information science research that began with Robert S. Taylor's (e.g., 1986b) studies of information use environments. In the business environment, this line of research crosses over into the management information system (MIS) literature.

MIS administrators and market researchers address methods of assessing information needs and demand for information services. Gordon B. Davis and Margrethe H. Olson (1985) provide a review of the concepts and development of MIS and James A. O'Brien (1996) provides an excellent current overview of MIS in the networked environment. O'Brien states that MIS studies of user information needs have changed their focus over time. Earlier studies focused on the internal needs of the organization, typically, the management of operations and keeping books, while more recent research focuses on the information needs arising from strategic planning, particularly the need to recognize and seize business opportunities, and solve business problems. Current MIS research that relates to seizing strategic advantage and recognizing problems fits well with Taylor's research approach to the information use environment. MIS studies were included in the discussion of the business context of the subjects of the present study.

Red Angus cattle breeders, the subjects of this study, were considered as a group, defined by their shared business information needs. No attempt was made to prototype

the typical user from the group of subjects used in this research. The use of statistical averages to represent the user is misleading, according to Kunz, Rittel & Schwuchow (1977). These authors argue that user groups should be defined primarily by a particular set of information needs. In the context of the present research, users were considered to be members of a group characterized by their common need to plan and manage a ranch business. The user group was thus defined by their information needs arising from shared business problems and opportunities. Each individual member of this group has varying sets of information needs arising from a range of situations other than managing a ranch or situations that are unique to their ranch. Therefore, the needs of the individual user were addressed only if they relate to information needs shared by other users. The user group of cattle breeders engaged in the process of cattle breeding may be only one of any number of types of groups to which an individual rancher may belong.

The business of cattle breeding was considered in general terms, rather than as particular to the breeding of Red Angus cattle. Even in the context of specified problems of ranch management, the user group was expected to vary in several important ways, including the way in which they use information technology. Kunz, Rittel, and Schwuchow (1977) distinguish among four distinct types of users of information services: the potential user, the expected user, who is known to intend to use certain information services, the actual user, who uses a particular information service but may or may not benefit from it, and the beneficiary, who derives an advantage from an information service.

Users who responded to the surveys used in the present study were expected to belong to each of these categories. The entire group of users who breed Red Angus cattle were considered potential, or prospective, users of networked information services provided by the RAAA. One purpose of the first survey of all registered Red Angus

breeders was to estimate what proportion of prospective users were expected users. The follow-up survey addressed actual or interested users and asked about advantages of using networked information services to determine if they were indeed beneficiaries.

Taylor discusses the characteristics that can be used to distinguish sets of actual or prospective users. He emphasizes characteristics of the organizational context in determining individuals' information needs, an approach that was used in the present study of information aspects of the work of cattle ranchers. Of the other characteristics he lists-demographic, non-demographic, geographic, social, cultural and intellectual-three were used in the present study. Herd size was used as the primary demographic aspect to describe this group of network users. Geographic and several non-demographic factors were also considered in the present study. Geographic factors were included because they affect the kinds of problems that Red Angus breeders encounter. Several critical success factors, such as weather and water, vary widely across the United States and Canada. The non-demographic factors considered in the present study include ranchers' attitudes toward the role of computer networks in their business and their perceptions of the value of information.

Mary Lorraine Duvall (1993), in her study of problematic situations and information needs of software managers, found that managers' actions depended upon many technical and non-technical factors of the business situation in which they found themselves. Thirty-two managers from 14 companies in the United States and Japan were interviewed. Managers' comments in the interviews pertained to the context in which they used information, why they needed or used the information, the source of the information, the content of the information, and the problems that they had getting or using the information. These factors were defined in the present study as source of information, type of information, barriers to access, and barriers to use.

Information needs have their origins in incongruities, discontinuities, anomalous states of knowledge, or problems that arise as users attempt to construct sense in specific, concrete, and dynamic situations (Rosenbaum, H., 1996, p. 152). This definition of information need covers the spectrum of the current research agenda in the information sciences. The present study focused only on one aspect of this definition, i.e., the information needs that arise from problems encountered in managing a ranch.

Carter (as cited in Frank, 1987) identifies the information needs of agricultural workers as operations and production management, financial management, community interaction, and personal and family concerns. In his testimony before Joint Congressional Hearings held during 1982 on the changing information needs of rural America, Carter stated that information technologies can play a major role in meeting these needs, but that he believes the government must take the lead in encouraging the private sector to design programs and services specifically to respond to the wants and needs of the agricultural community.

Robyn C. Frank defines the information needs of farmers and ranchers as production, marketing, and consumption, as well as information to help them manage their lives successfully, cope with everyday problems, and realize opportunities (1987, p. 300). Frank's list of information sources available to farmers and ranchers includes colleagues, friends, community leaders, other farmers, service agents, extension agents, rural and popular press; direct use of computerized and electronic services, libraries, radio and television, and exhibitions.

Robyn C. Frank explicitly states that little has been published about the information needs of the U. S. agricultural community. This lack of research is disturbing, because development of information products and services should be based on marketing research studies of current and potential users (1987, p. 297).

Katzer and Fletcher (1992) conclude that information scholars and professionals can better understand user information behaviors (or information actions) through knowledge of the users' information environment. An information environment can be thought of as the context or setting of the managers' business problem situations.

In summary, Red Angus breeders, the set of users considered in the present study, are defined by the core information needs they share. Further, information needs are defined as arising from the problems and opportunities involved in managing a breeding operation. This context is first examined as the general environment of managers.

Information use environments of managers

The question "What is the context of management?" relates closely to the question: "What do managers do?" Communication scholars who study management focus on types and styles of communication. Business scholars speak of the functions of management (planning, organizing, controlling, staffing, and directing), the roles of management, and management style. Information science scholars who study the information needs and uses of managers use more general terms such as context, problematic situations, information problems, information behaviors, and information use environments.

The work of managers as discussed in the business literature is primarily an outgrowth of the management theories of Henri Fayol, published in the early 1900s. The traditional functions of management can be conceptualized as managing information and managing people. Organizing work by delegating authority, directing, and recruiting or growing a staff are activities that many ranchers engage in. As these functions of management pertain primarily to managing people, they were not directly considered in the present study. Rather, the information-intensive management functions of planning and controlling were the focus of studying the information needs of ranchers.

Typical outcomes of controlling an operation include modifying plans and making decisions. Controlling involves observing business operations and monitoring the external environment (O'Brien, 1996). Controlling is considered to be an information-intensive function because it essentially involves establishing feedback loops and evaluating resulting information. Planning involves the development of both long and short-term goals, the recognition of both problems and opportunities, and the evaluation of alternative courses of action. Thus, both planning and controlling involve solving problems and making decisions. For purposes of the present study, controlling was considered a special case of planning and the information-intensive aspects of the environment of managers are defined as planning, decision making and problem solving.

Managerial action, including information behavior, is widely characterized as decision-making. Drucker outlines three important skills for managers. One of these is communications within organizations. Another is the making of decisions under conditions of uncertainty. And there is also a specific entrepreneurial skill: strategic planning (Drucker, 1973, p. 17).

The information environment of managers can be further defined as the typical business situations that mangers encounter. Business situations can be conceptualized with the ten roles of management identified by Mintzberg (1973). These are interpersonal roles (figurehead, leader, and liaison), informational roles (monitor, disseminator, and spokesperson) and decisional roles (entrepreneur, disturbance handler, resource allocator, and negotiator). It should be noted that Mintzberg stresses that information is a key resource in each of these roles. The managerial roles addressed in the present study are the ones Mintzberg characterized as decisional: planning (resource allocator), problem solving (disturbance handler), and decision-making (entrepreneur and negotiator).

Taylor (1987) discusses four characteristics of information use environments: 1) a particular set of clients, the actual or prospective users, 2) the organization or setting, 3) clients' typical problems, and 4) the solutions or information expected by clients.

Taylor defines an information use environment as the set of those elements that determine the flow of information and the value created in the process. An IUE (information use environment) is defined as the set of those elements (a) that affect the flow of information messages into, within, and out of any definable entity or group of clients; and (b) that determine the criteria by which the value of information messages will be judged in those contexts (Taylor, 1986a, pp.34-35).

These IUE elements fall out into four categories: sets of people, the structure and thrust of problems typically experienced by these sets of people, mutually held assumptions about the nature of typical problem resolutions, and characteristics of the setting (Taylor, 1991, p. 221). Problems arise within environments. Problems, in turn, determine information needs, out of which arise information behaviors. This insight was a thread throughout Taylor's work and provides a conceptual path for designers of new information systems to work their way backward through the information use environment from behavior, to needs, to root problems.

Problem-solving

The context of management is defined here as a set of problems. Problems are defined broadly to include recognizing opportunities and performing the full range of management roles and functions. Information needs are considered to arise from the management process.

In the field of library science, methods of analysis of information needs include ought to need statements, e.g., core collection lists, potential need statements, demand

studies, goal-oriented analyses, demographic studies, user studies, lifestyle studies, required output studies, and effectiveness studies (Hill, 1987). Most applicable to the present research into the business information needs of cattle ranchers is the goal-oriented analysis method.

Goal-oriented analysis begins with the assumption that information is used is to solve problems. The goal-oriented method has been used in library research primarily for specifying the requirements of relatively homogeneous groups of users of special-purpose library collections, and therefore the goal-oriented approach fits the requirements of the present research. It also provides support for the method of delineating first the business problems, which give rise to information needs. Susan E. MacMullin and Robert S. Taylor define a problem as an initial state, the goal state, and the process (es) which are mental, physical, or perceptual activities required to move from the initial state to the goal state. The problem requires information which makes connections between the initial and the goal state (1984, 95-96).

This goal-oriented method has been adopted from library studies for use in information science research. Belkin (1980) states that information science is a problem-oriented discipline, and Hoglund & Persson (1982) emphasize that the nature and goals of a user's work determine information needs as well as the conditions of information use. Kochen states that acquiring and using knowledge about the effective use of information for decision-making, planning, problem solving, and coping is one of the major responsibilities of the information professionals/scientists in this decade (1983, p.298).

Taylor states that a valid approach to designing information systems and services is to first look at the kind of problems clients encounter every day. Taylor summarizes the user driven approach to system design as two questions:
Without preconception as to technology or content, what are the kinds of

problems that people (engineers, doctors, managers, scientists, farmer, etc.) have in the environment in which they live and work? How can these problems and their context be translated into information terms? (Taylor, 1987, p. 331)

Jeffrey Katzer and Patricia T. Fletcher, in a review of the information environment of managers, speak of problem dimensions characteristics of problem situations. Examples they give of possible problem dimensions of a merger situation are new, scary, and involve working with others. Furthermore, the environment of the problem situation affects managers' perception of these dimensions. The salience of these dimensions (novelty, risk, and interpersonalness) is affected by who the person is and what setting he or she is in. The dimensions perceived as important may also affect what information is sought and how it is valued. Information, in turn, may also change the relative importance of the different dimensions (Katzer & Fletcher, 1992, p. 233).

<u>Planning</u>

In the environment of managing a ranch, there is a need to manage day-to-day operations and also to continually scan the external environment for strategic planning purposes. Environmental scanning is information from outside the immediate setting or information about the outside world. Choo and Auster (1993) define environmental scanning as the acquisition and use of information about events and trends in an organization's external environment, the knowledge of which assists management in planning future courses of action.

Taylor (1986b) and Katzer and Fletcher (1992) include in their summaries of the information needs of managers the critical need for external information. Choo and Auster (1993), in generalizing from studies of how managers acquire and use information, found that managers indicate a substantial need for information about the external environment. Choo and Auster also point out that research on scanning has

found that managers who face higher levels of environmental uncertainty tend to do a greater amount of environmental scanning. They also found that market-related sectors of the external environment, including customers, suppliers, and competitors, are important aspects of information scanning. However, in their review of small business and information technology literature, Glynn and Koenig (1995) found several studies that suggest that managers over emphasize the short term at the expense of long term planning.

An influential view of the management role of planning comes from John P. Kotter. In an in-depth study of 15 managers, he found that they encounter two major kinds of problematic situations, or, to use Kotter's term, dilemmas. These are: (1) to figure out what to do despite uncertainty, diversity, and an enormous quantity of potentially relevant information, and (2) to get it done through a large and diverse group of people over whom they have little or no direct control (Kotter, 1982a, p. 76). The first of Kotter's management dilemmas relates directly to the present study. Kotter characterizes the actions that arise from the need to deal with uncertainty as agenda setting. Agenda setting is expressed in behaviors such as defining goals, strategies, and priorities. Kotter found that managers who continually develop their agendas by seeking information from a wide variety of sources were more successful as managers. Like Mintzberg, Kotter's work can be characterized as defining a set of problem situations that give rise to managerial action, including information actions.

In the context of the present study, planning involves articulating a mission for the ranch, setting goals, devising strategies and making action plans, taking action, and evaluating outcomes. Planning is conceived broadly to also involve recognizing opportunities, diagnosing problems from symptoms, and considering alternative courses of action. Long-range business planning is typically an ambiguous, unstructured problem.

Planning is necessarily future oriented and must be based on information from both inside and outside the business.

Decision-making

Business decision making can be characterized as first setting goals, searching for alternatives, and finally selecting actions that lead to the goal. The role of information is to reduce uncertainty associated with decision making.

Ranching is risky business. Ranchers almost never enjoy the luxury of making decisions under conditions of certainty. Therefore, according to the traditional decision-making theory of Simon (1977), information is critical for ranch managers. Uncertainty and conflict over the allocation of scarce resources are usual aspects of ranchers' environment.

Many formal approaches have been developed to quantify resource allocation decisions, most notably in the fields of management, finance, and economics. These approaches derive, in part, from expected utility theory (von Neumann & Morgenstern, 1947) and value-based decision models such as prospect theory (Kahneman & Tversky, 1979). However, quantitative value-based decision models assume stable values and preferences, and people can not always assign clear values, and their preferences are not stable constructions (Payne, Bettman, & Johnson, 1992). More common in the current business literature are reason-based decision models that explain choice as balancing the pros and cons of each decision alternative. Conflicting reasons used to weigh decisions are more difficult to compare than numerical values, but the concept of choice guided by reasons provides a natural way to understand conflict in making decisions (Shafir, Simonson, and Tversky, 1997).

The reason-based approach to decision making was taken in the present study. This is not meant to imply that financial models of decision outcomes or formal

operations planning can not be used to good advantage in the ranching business; they can. However, for the purposes of assessing the business information needs of ranchers, a reason-based concept of decision making is assumed to give rise to a wider range of information needs. These needs include, but are not limited to, information needed to identify and estimate the value of alternative courses of action. Reason-based decision making was assumed to provide a better means of identifying information needs that arise from weighing conflicting reasons, because conflict itself gives rise to the need for information as input to make a choice.

Decisions generally become more difficult to make as the number of alternatives, contingencies, or conflicts increase (MacMullin & Taylor, 1984). However, if the situation becomes too confusing, people use a number of different information-processing strategies to simplify their choices. Examples, primarily from the psychological literature, include simplification processes such as elimination of aspects of the problem from consideration and weighting each alternative equally while still attempting to assign a value to outcomes (Payne, Bettman, & Johnson, 1997). Environmental factors such as time pressure will also restrict the amount of information considered in reaching a decision (Simon, 1981). Willingness to satisfice rather than continue seeking information also comes into play.

Decision-making is influenced by cognitive effort (Simon, 1955). Different decision making strategies carry different cognitive loads. Estimating expected utility, for example, requires the person to process all relevant information for each decision alternative, weigh trade-offs, and assign probable values. In contrast, the lexicographic choice rule developed by Tversky (1969) chooses the best alternative for the most important attribute (possible outcome) of the problem situation, ignoring most other potentially relevant information.

Choice environments and task demands also influence the information components of decision-making strategies (Payne, Bettman, & Johnson, 1992). Bettman (1979), for example, proposes that people construct their simplifications and strategies as the decision process unfolds rather before it begins.

G. Anthony Gorry and Michael Scott Morton (1971), propose that managers' information needs can be attributed to the degree of decision structure. These authors concentrated on the decisions needs of managers at different levels of an organization and distinguished among operational, tactical, and strategic levels. For purposes of the present study, it was assumed that ranchers assume all these levels and encounter the full range of the decision structure outlined by Gorry & Morton as structured, semistructured and unstructured. Unstructured decisions typify planning and problem solving processes and relate most closely to the context of the present study. Unstructured decisions are defined as situations for which it is not possible or desirable to specify procedures to follow in advance (O'Brien, 1996, p. 362).

In summary, Red Angus breeders, the set of users examined in the present research, are assumed to encounter the same challenges as do managers in general, those being defined here as making plans, solving problems, and making decisions. Further, the information environment of cattle breeders must be considered in the particular setting of ranch management.

The information environment of ranchers

Ranching and ranch management provide the environment and context for the present study. The information use environment of ranchers was therefore defined as a set of management problems. Information needs were then specified as arising from the set of problems identified.

As stated previously, ranchers are managers: they plan, make decisions and solve problems. Ranches, however, do not resemble the large industrial organizations that provide the usual context of management theory, but rather are information-intensive enterprises. Peter F. Drucker addresses this point in his discussion of information-based organizations. Here he speaks of the typical large organization twenty years hence:

> In its structure, and in its management problems and concerns, it will bear
>
> little resemblance to the typical manufacturing company, circa 1950,
>
> which our textbooks still consider the norm. Instead, it is far more likely
>
> to resemble organizations that neither the practicing manager or the
>
> student of management and administration pays much attention to today:
>
> the hospital, the university, and the symphony orchestra. For, like them,
>
> the business, and increasingly the government agency as well, will be
>
> knowledge-based, composed largely of specialists who direct and
>
> discipline their own performance through organized feedback from
>
> colleagues and customers. It will be an information-based organization
>
> (Drucker, 1989, p. 207).

Ranchers use information to manage their business from the time they wake up until the time they go to sleep. Much of their information comes from the external environment and much of it can be perceived through the senses. Decisions and thoughts require information about the environment if they are to be optimal, or even satisfactory.

Mintzberg (1983) asserts that information is a key resource in making plans, solving problems, and making decisions. According to Mintzberg's argument, managers' roles of decision-making and problem-solving give rise to information needs.

Planning, especially long-range planning presents problems of discovery that can only be addressed with external information sources. The information behavior that typically arises from problems of discovery, including long-range planning, can be characterized as environmental scanning. Environmental scanning includes monitoring the environment for evidence of trends and incidents, which could seriously impact the enterprise. Environmental scanning is akin to Simon's concept of intelligence gathering for use in making decisions. Mangers use environmental scanning in the planning process to reduce uncertainty, to keep up, to monitor competitors, and to help identify problems and opportunities arising from changes in the environment in which they operate. This aspect of environmental scanning can be characterized as looking over information as contrasted with looking for information, which is a more directed searching behavior, typically evidenced in the problem-solving process. In the business literature, information scanning is typically associated with strategic aspects of management, whereas searching is more often associated with operational, diagnostic kinds of problems that are better understood or have more structure.

In the present study, the concept of environmental scanning was taken from one of the earliest and most important studies in this area of research, published by Francis Joseph Aguilar in 1967. Aguilar defines environmental scanning as scanning for information about events and relationships in a company's outside environment, the knowledge of which would assist top management in its task of charting the company's future course of action (Aguilar, p. 1). This definition probably accounts for the term's association in the business literature with long-range planning. However, Aguilar goes on to identify aspects of scanning that make the concept applicable to problem solving as well. Aguilar defines four modes of scanning: undirected viewing, conditioned viewing, informal search, and formal search.

An example of undirected viewing in the context of the present research would be a conversation the rancher has with anyone in any setting that relays information that attracts his interest or concern in his role as ranch manager. Because ranch life is relatively isolated from face to face contact, ranchers do not have the opportunity to just listen in and ask questions as do scientists, engineers, doctors and lawyers. Many studies have shown that workers as well as managers prefer other people as primary sources of information (Katzer & Fletcher 1992; Frank, 1987; Bishop, 1994). The structures of many professions allow more frequent contact with related parties than does ranching, and availability consistently shapes information seeking.

A rancher may not prefer electronic communication, but it may be all that is readily available. In an electronic environment, an example of undirected viewing is navigating online services to see what is available. An example of conditioned viewing is finding information pertaining to a particular area of interest and assessing its usefulness. In the third mode, informal search, a user might look for information about a specific issue, but do so in an unstructured way. In the fourth mode, formal searching, a network user deliberately looks for specific information about a specific issue.

Chun Wei Choo and Ethel Auster (1993), in their review of environmental scanning and the acquisition and use of information by managers, found a growing awareness of the value of environmental scanning. They also note a relationship between perceived environmental uncertainty and increased environmental scanning activity, as well as the importance of market-related sectors of the external environment, including information on customers, suppliers, and competitors. They also confirm the relative importance of personal sources such as customer, associates and staff. Two hypotheses in the present study relate to the importance of the market sector and the importance of personal sources, respectively.

Intentional Action

The present study assumes information-seeking behavior in the context of management to be intentional behavior. Therefore, intentional action is considered an appropriate theoretical basis for examining the ranch management process.

Theories of intention provide a link between the environment and information use, or information actions. Intentional action can be conceived as the link between the user as figure and the user's context as ground. In the information sciences literature, information needs perceived by users are closely coupled with information actions, or what is more commonly referred to as information behavior. Communication theories of intentional action are used as a basis for this discussion. These theories relate desire, need, and action in the context of intentionally. Theories of intention are related to the traditional management model of the planning process to place the discussion in context.

In his article, "Intentional Action," Goldman (1992), argues that our wants and desires cause the acts we perform intentionally. Goldman rejects the mechanistic/deterministic view that human behavior is a series of reactions to external stimuli, in favor of the view that people choose their actions based on their desires.

Goldman's conceptualization of action arising from intention that arises from need or desire can be modeled with terms borrowed from the traditional business planning cycle. The business planning process is commonly defined as the imperative to find a mission, develop strategies, set goals, make action plans, take action, and evaluate effectiveness. This model of intentional action is circular rather than hierarchical if conceptualized as a complete feedback loop.
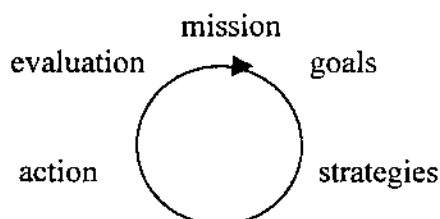
The motivation for action can be viewed as arising from an individual's or an organization's mission. An organization is a community of individuals with shared interests, and, as such, includes the context of the ranchers association, the ranch, and the individual rancher. In the organizational model, the mission statement addresses the questions: "What do we value? What do we want? An organization's goals address intention: "What do we want to accomplish?" An organization's strategies address intention at a greater level of detail: "How do we intend to reach our goals?" Evaluations answer the questions: "What actions have taken place?" and "Are we living up to our mission?

Managers' actions, especially over time, almost always take place in an unstructured environment. This is especially true for ranchers. The concept of management intent as arising from a many-to-many process is necessary for the planning model to accommodate changes in plans and unanticipated problems. However, the traditional management model conceived as a sequential feedback loop is adequate to provide a single frame of reference to pull together the preceding review of literature from different disciplines.

Putting user needs and the context together

Intentional action theory is used in this study to describe the management process in a context that relates information needs, information use and the use environment and for relating terms from several disciplines, as shown in Table 2-1.

Table 2-1

Relationship of terms used in the present study

	Communication	Business Planning Model	Information Science	Management Decision making Model
Point of view in the context of the present study	Receiver, actively seeking information	Ranch owner or manager	End-user as primary client	Owner or manger in the context of business problem solving
What is desired?	Information based on desire arising from receiver's view of the world	Mission	Information to fill a recognized need	Intelligence (understand the context, diagnose problems, search for opportunities, identify information needs)
		Goals		
How is desire expressed?	Intention	Strategy	Information seeking	Design (identify and evaluate solution strategies)
How is intention expressed?	Attention	Action plans	Information selection	Choice (select a course of action)
	Interaction with mediated communication	Action	Information use	Implementation (implement, monitor, provide feedback on the success of the implemented decision)
What is achieved?	Perception of value of message content	Evaluation	Perception of value of information use	
How can achievements be judged?	Feedback to sender or source	Refine plans	Feedback to the info provider	

The problem-solving aspect of planning is represented with Herbert A. Simon's model of the decision-making process as intelligence, design, and choice activities (Simon, 1977). In the diagram of terms used, implementation activities were added to reflect a fourth stage of the decision making process. The four-stage model reflects the work of other researchers who emphasized that managerial decision-making is typically a problem solving process (Gorry & Morton, 1989). This model of decision making in the context of business planning and problem solving is related to the terminology of intentional action theory. Simon's decision-making model and A. I. Goldman's model of intentional action relate to each other through their correspondence with the business-planning model, as shown in Table 2-2.

Table 2-2

Management Information Model

Management Decision making Model	Business Planning Model	Management Information Model
Owner or manger in the context of business problem solving	Ranch owner or manager	Owner/manager Engaged in planning And problem solving
Intelligence Activities	Go on a mission	Scan the environment
		1. Identify problems and opportunities
	Set goals	
Design activities	Develop strategies	2. Pose questions
		3. Devise plans
Choice activities	Make action plans	Identify information components of plans
Implementation activities		Seek information
	Take action	Select information Use information
	Refine plans	Evaluate outcome of information use
	Re-evaluate mission	Refine understanding of the business context

Diffusion of innovations to rural communities

The present assessment of information technology acceptance in the nationwide

rural community of Red Angus cattle breeders is based on the innovation diffusion theory

of Everett M. Rodgers (1995). Rogers proposes five characteristics of new technology

that affect the rate of diffusion: 1) relative advantage (over current methods), 2) compatibility (with users' environment), 3) complexity (of learning to use), 4) trialability (before making a commitment), and 5) observability (of benefits of use). Rogers distinguishes four categories of technology users according to how quickly they accept new technology: innovators, early adopters, early majority, late majority, or laggards. In the present study, individual users were expected to belong to each of these categories when compared to user acceptance of information technology and networked information services in the total population of the United States. Rogers estimates that innovators and early adopters constitute only 16% of the total population. Subjects in the second survey will likely belong to the innovator and early categories of users within their own particular group of breeders. Dillon and Morris (1996) state that profile studies of adopter categories point to personality and socioeconomic variables that distinguish them. Early adopters are characterized by risk-taking, adventure seeking, education, and wealth.

Diffusion studies undertaken in the sociological tradition growing out of Rogers' early work focus on technology transfer rates and the impact of technology on society. Studies of user acceptance can be subsumed under the umbrella of sociological diffusion studies, but the user acceptance stream of research also addresses individual user psychology. Much user acceptance research stems from the theory of reasoned action proposed by Ajzen and Fishbein (1980), scholars in the field of social psychology. This theory posits that behavior, such as acceptance or rejection of technology, arises from intention which is influenced by individual attitudes and the norms of the individuals group. Furthermore, according to Ajzen and Fishbein, beliefs and feelings about the consequences of behavior determine attitudes.

Positive attitudes have been found to be positively correlated to increased experience with computer-based information technologies for both rural and urban

residents (LaRose & Mettler, 1989). Many surveys have shown rural residents to be less likely than urban residents to have computer and digital telephone technology in their homes (Dillman, 1984). However, LaRose and Mettler found no evidence of a rural mindset that resists the adoption of information technologies. They assert that rural users' slower adoption rates can be adequately explained by the confounding variables related to available telecommunications services.

Issues related to technology adoption are discussed in a wide range of forums. Andrew Targowski, in The Architecture and Planning of Enterprise-Wide Information Management Systems (1990), addresses the social engineering aspects of information systems. According to Targowski, informational transformation in society is based on social awareness of information systems, comprised of biases, beliefs, and expectations. Survey questions of RAAA members that were based on these theoretical assumptions included those regarding what, why, and what next aspects of information technology adoption and attitudes about the value of its use.

An MIS related model, the technology acceptance model, was derived by Fred D. Davis (1989) based on Ajzen's and Fishbein's more general model of reasoned action. Dillon and Morris (1996) provide excellent diagrams of both the reasoned action theory of Ajzen and Fishbein and the technology acceptance theory of Davis in their review of user acceptance of information technology. Because it has been shown to be a better predictor of adoption behavior, the present research adopts the argument of Davis and his colleagues that perceived usefulness directly affects intention. This stance is in contrast to Ajzen's and Fishbein's reasoned action theory, which argues that usefulness is a belief that is mediated by attitude. In the present research, Davis' argument is the basis for hypothesizing that the perceived usefulness of computer network services, as shown in

question 9 in the first survey (see Appendix B), relates directly to expressed interest in using or intent to use network services.

Adoption of technology has been shown to depend upon many factors. Mooer's law states that an information system will be used only if it is more trouble not to use it than it is to use it. Andrew Dillon and Michael G. Morris (1996), review user acceptance of and resistance to information technology, which were defined as advantages of and barriers to the adoption of information technology in the present study.

The United States Department of Agriculture (USDA), the Rural Information Center, and the federal, state and county agricultural extension system have a well-established history of innovations in information transfer to rural businesses. For example, the Green Thumb videotext experiment carried out by the Cooperative Extension Service and the USDA during 1980 and 1981 in Kentucky was an early, successful demonstration of the feasibility of providing computer-based information services directly to farmers and ranchers (Rice and Paisley, 1982). This experiment highlighted the increasingly intensive information seeking aspects of farming and ranching. Kentucky farmers were found to spend a goodly portion of their time reading trade magazines, listening to market and weather reports, and telephoning the local extension office, buyers and supply stores. Two thirds of the Green Thumb users were satisfied or very satisfied with the system, primarily because it offered them several kinds of needed information in one place.

<u>Technology diffusion</u>

Many new technologies, particularly complex technologies, carry intrinsic disincentives to their use. Bierma, Waterstraat, Kimmel, and Nowak (1997) identify six stages in the process of adopting an innovation: 1) ignorance, 2) awareness of other's need, 3) awareness of one's own need, 4) inform and evaluate, 5) adoption, and 6)

postpurchase behavior. For purposes of the present study, it was assumed that none of the subjects was in the first stage, characterized by ignorance of the existence of network information services.

Dillman (1984) lists five kinds of information technology of importance to the rural community: 1) expanding telecommunication capability; 2) hardware for using telecommunications; 3) information technologies embedded in tools and materials; 4) a rapid delivery system of goods and services; and 5) the capability of persons to effectively use technologies.

Despite the intrinsic disincentives that may exist to technology adoption, there are also powerful economic incentives to adoption of networked information services. For example, Tweeten (1983) found that the payoff from agricultural production research and extension (R & E) has been exceedingly high, typically averaging a 50 to 100 percent rate of return on investment. Similarly, Ullman, Williams, and Emal (1996) found that removing disincentives related to technological complexity resulted in increased demand for network services among rural communities in Nebraska.

Adoption of information technology by the ranching community

In the present study, the adoption of information technology by this particular rural community was investigated for the population of interest (Red Angus cattle breeders). The user information technology required for accessing prospective RAAA services is a computer, modem, and networking software that enables electronic transfer of information. As early as 1985, Martha E. Williams and Carolyn G. Robins, in their directory of agricultural databases, list 428 databases dealing with topics related to agriculture. AGRICOLA (Agricultural OnLine Access), produced by the National Agricultural Library (U. S. Department of Agriculture) is perhaps the most important of these with over 4,500 journal titles that are regularly scanned. AGRICOLA also includes

international literature, as does AGRIS, a database produced by the United Nations Food and Agriculture Organization. In an effort to avoid some to the overlap between AGRICOLA and AGRIS, the National Agricultural Library (NAL) in 1986 decided to focus AGRICOLA primarily on U. S. publications and cover foreign publication on a more selective basis. The NAL also now works with the land grant libraries to make publications of the state experimental stations and cooperative extension service available on AGRICOLA (Frank, 1987).

Information with potential value for cattle breeders was burgeoning on the network during the period of this study, 1995-1998. For cattle breeding research scientists, for example, a short list as of October 30, 1996 of databases with potential value to both animal science researchers and the larger group of RAAA web site users is shown following. This list can be thought of as part of the reference section for a digital library for RAAA members or for the RAAA staff to use in searching for research results related to cattle breeding.

- AGRICOLA, the database of the National Agricultural Library with comprehensive coverage of worldwide journal literature and monographs on agriculture and related subjects: animal studies, botany, chemistry, entomology, fertilizers, forestry, hydroponics, soils, and more.

- AGRIS INTERNATIONAL, a comprehensive database of worldwide agricultural literature.

- CRIS/USDA, current research information of the U S Department of Agriculture. Provides access to information on federal and state-supported research in agriculture, breeding and ranching. Describes projects of state agricultural experiment stations, colleges of veterinary medicine, and other state institutions.

♦ CAB ABSTRACTS, Commonwealth Agricultural Bureau with abstracts of important articles from a range of journals that cover animal breeding, veterinary medicine, arid lands, weeds, and economic information from around the world.

Hiltz (1988) has investigated the use of computer-mediated communication among geographically dispersed scientific and technical constituencies, which may also pertain to the geographically dispersed community of Red Angus cattle breeders. Likely shared advantages include: reduced time to contact some people, reduced travel, less bound by distance and time, and the availability of information useful for accomplishing work tasks.

Specification of business problems of cattle breeders

The management information model is used as a guide to understanding the business environment of cattle breeders, as well as their challenges and opportunities. Breeders' business situations and problems are investigated as a basis for identifying information needs.

Based on initial interviews with RAAA personnel, several specific business problems were identified for consideration in the present research. These problems were: (1) the ability to compete, (2) succession of ownership and land use planning, (3) tax and estate planning, (4) land conservation, (5) water resources, and (6) cattle health.

This set of problems related to the ranching business gives rise to information needs. These information needs are, in turn, the basis for selecting questions to ask on both of the surveys sent to Red Angus members.

Problem 1: Ability to compete

Many costs of production associated with ranching are beyond the control of individual ranchers. As in other businesses, such costs include property taxes, federal and state taxes, health insurance, the cost of land, and the cost of debt. In addition,

ranchers have very little control over market prices of inputs such as equipment and cattle feed other than the decision to build or grow ones own. Likewise, ranchers have little control over output prices such as auction values for commercial cattle or bid prices for breeding services.

Small ranchers are concerned that large cattle operators are making it increasingly more difficult for the little guys to compete. But has the distribution of ownership of land has changed in the cattle business? This question can be examined only in general terms because ranches are classified as farms and cattle classified as an agricultural crop in governmental statistics. The Bureau of the Census designates land in farms to consist primarily of agricultural land used for crops, pasture, or grazing. It also includes woodland and wasteland not actually under cultivation or used for pasture or grazing, provided it was part of the farm operators total operation. The Bureau's definition of a farm itself has changed nine times since first defined in 1850. The current definition, used for the statistics presented here, is any place for which $1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the census year.

Wright (1995) notes that the number of family farms is falling because almost all farms are family farms and the total number of farms is falling. Indeed, over the past sixty years, the majority of family farms have disappeared, usually because the operator retires or dies without being replaced by an heir interested in and capable of taking over the farm. But family farmers still till the land and raise hogs and calves. Each farm family now works with much more land, however, and many small farmers are now mostly, in terms of labor allocation, not principally farmers at all.

The common wisdom that U. S. farms are increasing in size and precipitously decreasing in number does not appear at first to be borne out by census statistics. In 1982

there were 2.2 million farms, in 1992, there were 1.9 million, a decrease of only 14%.

Nor did the percentage distribution of farms by number of acres shift dramatically from

1982 to 1992. For example, land holdings of farms with more than 2,000 acres only

increased three percent from 1982 to 1992, from 47 percent of all agricultural land to 50

percent. However, a different picture emerges if one manipulates the numbers in ways

other than those presented by the Bureau of the Census in its 1994 census report,

specifically, Table No. 1073. Farms, Number and Acreage, by Size of Farm: 1982 to

1992. In 1982, the total number of farm acres was 987 million: By 1992, the number had

fallen to 946 million, a decrease of 41 million acres. However, by taking cumulative

totals, one finds that in the categories of farms with fewer than one thousand acres, the

decrease is 56 million acres. The compensating difference is the gain of 15 million acres

in the category of farms with more than thousand acres.

Table 2-3

Numbers and sizes of farms

	Number of Farms (thousands)				Land in millions of acres			
	1982	1992	Change in number	%of total farms	1982	1992	Change in acres	% of all land in farms
Total	2,241	1,925	-316	100	986	945	-41	100
Large 500+ Acres	366	359	-7	19	740	744	up 4	78.8
Medium 50-499 Acres	1,232	1,012	-220	52	233	190	-43	20
Small 1-49 Acres	637	554	-83	29	13	11	-2	1.2

What then can we conclude about the actual shifts in ownership distribution from the U. S. census statistics? In the ten years from 1982 to 1992, the number of large operators increased by 6,000 and the number of small operators decreased by 272,000. In effect, large operators displaced small operators by a ratio of 45 to one.

Small ranchers are also concerned about their ability to keep up with the breeding technology needed to remain competitive. According to George E. Seidel (1989), biotechnology has great potential impact on animal agriculture. In the next several years we can expect to see animals with genes from other species, offspring from either two female or two male parents, and animal clones numbering in the thousands. These creatures will resist diseases better, reproduce more efficiently, grow faster, and yield higher-quality products. Exotic as these methods sound, they will evolve from existing breeding practices that already have had dramatic benefits. Most of the new methods will enhance animal health. Most of the procedures are now being used on cattle, because they are too expensive to use on species such as sheep that bring in lower income per animal. Genes from other animals that provide resistance to a certain disease can be placed in the embryo of a farm animal. Another technique that holds wide implications for cattle breeding is transplantation of cellular nuclei. It could yield thousands of identical offspring unlike sexual reproduction, which produces unpredictable results. Another biotechnology that is developing rapidly for farm animals is in vitro fertilization (IVF), which involves extracting an egg and sperm from animals, mixing them in a test tube, and placing the embryo in another animal's reproductive tract to develop. Today this technique, because of its expense, is much more widely used with humans than farm animals.

Two more experimental techniques show longer-term promise, perhaps early in the next century. They are gynogenesis, in which an offspring is produced with only female parents, and androgenesis, in which two males are used to produce offspring. Androgenesis may be especially valuable because the genetic qualities of bulls can be predicted with precision using estimated progeny difference statistics. Superior offspring would be obtained by crossing two high-quality bulls rather than a superior bull with a female whose quality is uncertain.

The new biotechnologies are evolving from older breeding procedures, such as artificial insemination (AI). Artificial insemination is important because the process allows the semen from the best bulls to be identified so that it can be used repeatedly. These bulls can have tens of thousands of offspring each year if their semen is regularly collected and frozen. However, artificial insemination is used for less than 5 percent of the 32 million beef cows in the United States. In part this is because of problems with confining cows on the range. It is also difficult to detect the days when such animals are fertile. If animals fail to become pregnant in a breeding cycle, farmers' profits decrease greatly, since they cannot offset feed and other maintenance costs.

Another well-established breeding method is embryo-transfer technology. With this method, a valuable cow is inseminated, and a week later a technician recovers the embryo by irrigating the uterus. Then the embryo is placed in the uterus of a less valued cow, who carries the pregnancy to term. This leaves the high-quality animal free for rebreeding in later reproductive cycles, which occur every three weeks. Embryo transplant technology also has the potential to increase international trade in the cattle breeding business, as the costs are lower than transporting animals and embryos carry fewer diseases than semen or animals.

Biotechnologies for breeding raise concerns as well as advantages. Early adopters of new breeding technologies will benefit, but, typically, profits drop as other ranchers adopt innovations to remain competitive. New breeding technologies lead to more complex operations, making it even harder for small family operations to thrive.

Problem 2: Succession of ownership and land use planning

Many ranchers want to keep the business in the family and use the land for grazing, farming, and/or wildlife preservation. A common problem for these ranchers is keeping the family interested in a risky, marginal, isolated business. Let us characterize this concern as "How can we keep the kids down on the farm?"

Traditionally, one means of involving youngsters in the ranching business has been through participation in 4-H programs. Penny Risdon and Mina Ostergard (1995) managed a project to place 4-H educational materials on the Internet. Visuals in the form of graphs, charts, line drawings, and photographs were included along with text materials. This joint experimental project was conducted between the University of California Cooperative Extension and the State 4-H Program at the University of Tennessee to test electronic dissemination of agricultural information. The project covered 22 subject areas from beef to wildlife. This pilot project exemplifies the benefits of using electronic technologies to capitalize on existing cooperation between institutions and maximizing the outreach potential of the extension service. This project also provides a means of educating the children of ranch families and keeping them interested in the business.

The issue of land ownership by families over time is important to the welfare of human society and wildlife. The National Cattlemen's Association sponsored a telephone survey in 1994 of a randomly selected, nationwide sample of 400 cow and calf producers to learn more about the impact of their practices on the environment. One of their findings was that family continuity is an important factor in conservation of natural

resources. The January 1994 study of cattlemen showed that 78 percent intend to pass their cattle businesses on to their children or younger relatives. 42% of these operators had held the farm or ranch in the same family for over 50 years, 18% had held the same land for over 75 years and 12% for over 100 years.

Problem 3: Tax and estate planning

If we assume that the rancher has an heir interested in carrying on the business, the next problem of the planning process can be characterized as "How can we keep the farm intact for our heirs?" Many ranchers are asset rich but cash poor and must sell land or take out mortgages to pay inheritance taxes. In a recent newspaper article, Lee (1997) cites the example of Debbie Gillan, who in 1984 inherited 4,500 acres of Texas ranch land long held in her family, along with an $1.7 million estate tax bill. "I knew I'd probably go my entire life doing nothing more than paying off inheritance taxes," says Ms. Gillan (p. 1H). Lee also reports that some sources estimate that farmers' and ranchers' estates are six times more likely than others to face estate taxes, taxes that ranchers refer to derisively as death taxes. David K. Langford, rancher, and executive vice president of the Texas Wildlife Association echoes this view. "We committed two crimes: One, my mother died; two, we choose to keep wildlife habitat intact. And this is our penalty" (Lee, 1997, p. 2H). Mr. Langford and his wife are paying off a new 35 year mortgage to keep land held in the family, some since 1882, intact for their children who are now in their 20's. Estate taxes levied on land-intensive businesses also have external effects on wildlife and human communities when ranchland is sold to developers and parceled out for suburban development. Because of these external effects, various environmental groups support ranchers in lobbying for reduced estate taxes, including the Environmental Defense Fund, whose mission is to protect wildlife habitat and open spaces.

Problem 4: Land conservation

Many farming and animal feed yard practices contribute significantly to pollution from organic waste, chemical fertilizers, and pesticides. Harmful ranching practices such as overgrazing and over use of stock watering access points have led to soil erosion and silt build-up in rivers and streams (Daniels & Bowers, 1997). The USDA said in its 1988 review of soil and water conservation that topsoil on 173 million acres of 420 total acres of agricultural land is eroding faster than it can be naturally replaced. (Ulrich, 1989, p.vii).

The Conservation Reserve Program, a product of the 1985 Food Security Act, is a significant attempt to include environmental concerns into agricultural policy. Two smaller programs are related, the Wetland Reserve Program and the Water Bank. (Thurman, 1995). Between 1986 and 1989, 34 million acres were enrolled in the conservation reserve program. Between 1990 and 1994, only 2.5 million acres were enrolled. This difference can be accounted for by changes to the conservation reserve program made in the 1990 Farm Act that ranked farmers bids to take land out of production not by just the dollar amount of the bid but based on the ratio of an estimated environmental benefit per dollar spent by the government. Sinner (1990) criticizes the 1985-1990 version of the conservation reserve program. He argues that an estimated $200 million subsidy of less erosive farming and ranching practices would have had about the same overall effect on soil conservation as the $2 billion spent through the conservation reserve program between 1985 and 1990. Osborn and Heimlich (1994) argue that post-1990 enrollment in the conservation reserve program has been more successful in targeting acres subject to water erosion. This is important because the external effects (those that affect the non-agricultural community) are more closely associated with water-related rather than wind-related soil erosion. Overall, however, a

valid argument can be made that agricultural policy in the United States has done a great deal more harm than good in the area of land conservation. Agriculture is responsible for more of the pollution of the nations supply of fresh water than any other industry by far (Ulrich, 1989, p.vii). But are the farmers and ranchers to be held primarily responsible? From the 1950s to the 1990s agricultural legislation supported yield-increasing chemical inputs and discouraged crop rotation. Although current legislation is, on the face of it, more environmentally conscious, the chemical residues of past decades continue to percolate downward into the water table and soil erosion has impaired the natural watershed system. For purposes of the present study, it is assumed that ranchers as a group are interested in conserving their own range and are willing to seek information about how to accomplish this, with or without governmental price supports or incentives.

Problem 5: Water resources

Farming and ranching use 85 percent of America's annual consumption of groundwater for crops and livestock. Especially for ranchers in the semi-arid West, a good year for water can make the difference between grazing land and wasteland. Water conservation is an issue between farmers and ranchers and the rest of the community, particularly in southwestern states where water is scarce and the human population is growing rapidly (Daniels & Bowers, 1997).

Manuel Avalos and Timothy De Young (1995) discuss regulatory policies related to water. They assert that the benefits of regulatory policies usually result from policies that protect established interests. For example, state governments throughout the United States regulate privately owned water rights. The western states recognize prior appropriation; the first user in time has the right to use available water; and this first right to the water continues in perpetuity as long as the water is put to beneficial use. In times of shortage, this allocation systems holds, even if it leaves other users with no water

supply. Over the years, prior appropriation systems have been modified in some western states, but regulatory distinctions between prior claims of users still exist, and thus so does conflict between users.

Problem 6: Cattle health

Pedro Luis Jover (1991) surveyed cattle ranchers in Mississippi in an effort to determine their technical information needs and to explore relationships between the perceived need for information and demographic data. Jover found that beef cattle producers need information regarding health and herd management and that the need for information regarding controlling reproductive diseases varies with the number of beef brood cows owned.

William Frank Braden (1981) investigated the information needs and information sources of small farm operators in Texas. Braden refers to the transfer of technology and information to small farmers as being important in their struggle for economic survival. A mail questionnaire was used to gather information from 1,134 respondents. Braden found that most small ranch operators produce beef cattle, have sales of less than $20,000 annually from 50 acres or less, and rank information related to production and marketing as most important to their operations. The subjects in this study rated farm magazines as their top source of information, but most also rely on television and daily newspapers, as well. Braden concludes that the Texas Agricultural Extension Service must use various approaches to be more effective in reaching the more than 137,000 small farm and ranch operators in the state with useful information. He recommends more extensive use of mass media outlets and more extension service publications that relate directly to the information needs of small farm and ranch operators. Braden emphasizes the importance of future research to determine if, how, when, and why small farm and ranch operators

use available information as crucial to planning extension programs as well as other information campaigns.

Conclusion

Ranchers information needs were considered in the context of business management. In this environment, information needs were assumed to arise in the process of managing a ranch. The management process was generalized as intentional action and specified as a set of problems related to planning, problem solving and decision-making. The user of information and the context of information use were related to each other through the derived management information model.

CHAPTER 3

RESEARCH DESIGN

The research design used in the present study was a process of assessing cattle

breeders' information needs and perceived value of networked information access.

Methods used to assess the business information needs of Red Angus cattle breeders

included interviews with the industry research partner and two surveys of Red Angus

ranchers.

1) RAAA personnel were interviewed to discuss business problems of breeders

and ways to address information aspects of these problems with Web-enabled services.

2) A survey was mailed to RAAA members in 1995 to estimate the advantages to

them of networked access to information and the barriers to adopting the computer

technology necessary to support access. This survey was designed to answer research

questions one, two and three: What are the business information needs of Red Angus

cattle breeders? What information technology do they use? What barriers do cattle

breeders perceive to adopting computer network information technology?

3) A follow-up survey was mailed in June 1998 to gather information to evaluate

cattle breeders' perceptions of the advantages and barriers to using networked

information services. This survey was designed to answer research questions four and

five: What barriers do cattle breeders perceive to using computer networks? What

business advantages and disadvantages do cattle breeders perceive in using networked

information services?

The population for the follow-up survey was respondents to the first survey who,

at the time of the first survey, were network users or were interested and had the

equipment but were not yet using networked information services.

Interview with the Industry Partner to Specify the

Business Problems of Cattle Ranchers

The first phase of this research included an interview with Red Angus leaders

focusing on two points: the leaders' perceptions of the business problems confronting

their membership, and second, the problems or opportunities the Association itself

expected to address with networked services. Despite this two-tiered approach taken in

the interview, the primary client in this research was the end user of information, not the

information provider. In the present study, the Red Angus Association was designated as

the information provider, and the core membership of cattle breeders who supply data

input and who want online access to processed data were designated as the end users. It

was the breeders' shared set of business problems and information needs that were the

focus of this study. Thus, during this initial interview, the researcher's approach was to

give greater weight to the business problems of end users rather than the business

problems of the information service provider.

The interview with the industry partner was held in June 1995, with the executive

director, the marketing director, and the magazine editor of the Red Angus Association.

The goal of this interview was to formulate a clear understanding of the Association

directors' perceptions of the crucial problems and opportunities faced by their membership. A collateral goal was to find out what the Association directors perceived as the most important obstacles and opportunities in providing leadership for Red Angus breeders. One of the advantages the RAAA offered as a research partner was a well-understood business purpose and a documented strategic plan that had been fully negotiated with their members. Because these essential elements were in place, the next step was to specify the business problems of prospective core users, i.e., the breeders who register their cattle with the Association, and potential information needs arising from problems and the planning cycle. The interview questions asked were:

1) What is the general outlook for the cattle breeding business?

2) What are the ranchers' business problems and opportunities? What kinds of information might they find useful?

3) Which problems does the RAAA address with its current information services?

4) Who is the core market for the information the RAAA provides, and what is the general outlook for their use of information technology?

The results of this first interview are documented in Appendix A.

Specify Information Needs Arising from the Business Problems of Ranchers

Based on the initial interview with RAAA leadership, six classes of business problems, along with associated information needs, were identified for inclusion on the first membership survey.

Problem 1: Ability to compete. Related information needs: Auction values, general market information, and breed improvement information.

Problem 2: Succession of land ownership and land use planning. Related information needs: Environment regulations, government regulations, community information, education, and family health.

Problem 3: Tax and estate planning. Related information needs were described with these same terms, i.e., tax planning and estate planning.

Problem 4: Land conservation. Related information needs identified on the surveys were government regulations, environment regulations, agricultural chemicals, and pest management. On the follow-up survey, the term conservation was added.

Problem 5: Water. Water resources was the phrase used in the survey of types of information needed by cattle ranchers.

Problem 6: Cattle health: Veterinary information and breeding information.

Sources of information related to meeting the identified information needs for all problems (in varying degrees) were designated as: Customers, suppliers/vendors, other ranchers, ranching associations, extension agents, county/state health department, other government agencies, libraries, newspapers, industry magazines, bulletin boards, political alliance groups and "other" sources that the respondent was asked to list.

Information gathered from RAAA personnel and findings of previous related research gave rise to the following expectations that informed the design of the first survey:

1. The most valuable types of information are market-related. (Terms used to ask about the importance of this type of information were breeding information, auction values, and general market information.)

2. Direct personal sources in the external environment (customers, suppliers, and other ranchers and extension agents) are more valuable than groups (ranching associations, county/state health departments, other government agencies, and political alliance groups) and impersonal sources (libraries, newspapers, industry magazines, and bulletin boards).

3. Users' desire for networked access to a specific type of information varies directly with the perceived value of that information.

4. Cattle breeders' perception of the importance of networks varies directly with the length of time they have had access to the Internet.

5. Computer network use at a location other than the ranch is related to the decision to adopt computer networks for use at the ranch location.

The second survey, sent to a small sample of breeders who represent the most likely "early adopters" of networked information services, was also based on the preceding set of expectations and on user reposes from the first survey. In this second survey the terms conservation, tax, and estate planning were added explicitly to the survey.

For the second survey, two additional expectations pertained:

6. If respondents used networked services in 1995, their use will have increased significantly at the time of the second survey. This expectation was addressed by asking users the percentage of the workweek they spent accessing and using networked information services.

7. Problems that users report with using the Web will parallel the findings of the

first 1998 GVU survey of 10,000 Web users. This expectation led to the use of

GVU survey questions to ask users about the problems they encounter in using

the Web.

The second survey employed nine of the most business related terms from the set

of fifteen terms used in the original survey to describe types of information needs, and

three new terms are added: conservation, taxes, and estate planning.

Survey procedures

Questions asked on user surveys were based on the aforementioned business

problems of ranchers. This approach assumes that the user (receiver, information seeker,

cattle breeder) intends to address business problems, that the provider's (the RAAA)

intent is to provide networked information, and that the researcher's intent is to determine

information needs that arise from problems and to identify information via computer

networks that helps address information needs.

Questions included in the initial survey were designed to learn something useful

about networked access to information and users' perceptions. The goal of this initial

survey was to determine the types and sources of information most valuable to

prospective users and their perceptions about adopting and using information technology.

The surveys used in the present study were based on previous surveys of network usage

(Bishop, 1994) and information needs (Lundeen, Tenopir & Wermager, 1994). The

structure of the present survey is based on the work Ann Peterson Bishop, who

investigated the role of networks in engineering work. The survey used by Bishop (1994)

in her investigation was validated with findings from her previous related research and

with triangulated data from site visits, interviews, telephone surveys, and pre-tests results. Bishop's survey instrument was used in a project funded as part of the National Aeronautics and Space Administration and the Department of Defense aerospace knowledge diffusion research project.

Bishop's survey structure regarding the availability, use and value of computer networks was expressed in questions related to the context of: type of network, work resources, network applications, and aspects of work. Each of these survey categories is discussed and related to categories used in the present research. The types of network category is not included in the present research because network access by cattle ranchers is not considered to include local or organizational networks but only the external, public telecommunications network.

Bishop's survey asked about the use and value of computer networks in accessing work resources. The work resources category used by Bishop separately identifies human resources and information resources. Human resources included other people in the work group, in the organization, colleagues in business and academia, external customers or clients, and external vendors or suppliers. As distinguished from human resources, information resources identified by Bishop that most closely relate to the present research include journals, newsletters, bulletins, product or materials information, training materials, research data and production data. To better suit the context of the present study, Bishop's category of human and information resources was separated into information sources and information types.

The heading for the resource access question in Bishop's survey is Work Resources in Aerospace. In the present study, the headers read as Types of Information Needed by Cattle Ranchers, question 4, and Information Sources Used by Cattle Ranchers, question 5. Business information sources for ranchers were identified on the first survey as customers, suppliers/vendors, other ranchers, ranching associations, extension agents, county/state health department, other government agencies, libraries, newspapers, industry magazines, and bulletin boards. Business information sources for ranchers were identified on the follow-up survey with the same terms.

Types of information needed by ranchers were identified in the present study as breeding information, general market information, veterinary information, agricultural chemicals, pest management, water resources, environment regulations, weather, government regulation, community information, education, travel, family health, and other.

First survey of prospective users of information services

The initial survey was developed during summer of 1995, in consultation with the staff of the Red Angus Association of America. In August 1995, surveys were mailed to all 1067 ranching enterprises within the Association. The purpose of this survey was to answer research questions one through three about the business information needs of Red Angus cattle breeders, the information technology they used, and their perception of barriers to adopting computer network technology.

A reminder to members to respond to the survey was posted in two subsequent issues of The American Red Angus, the monthly magazine of the Red Angus Association of America. 209 surveys were returned by April 1996, coded for data entry and processed with SPSS software to tabulate preliminary results. The preliminary results of

the survey were shared with Association personnel in May 1996.

Survey responses were accepted for one year, through August 1996. 21 additional surveys received between April and August 1996 were tabulated manually and added to the totals previously obtained. The data on all 231 survey respondents (22% response rate) were given to the industry partner in September 1996. The survey questionnaire is shown at Appendix B. Specific results of the first survey are discussed in Chapter 4.

A total of 231 ranch representatives responded to the first survey of 1067 ranches, representing all 1600 registered Red Angus cattle breeders. Of these 231 responses that represent 22% of the population of 1067 ranches, 39 were excluded from the sample prior to analysis. Criteria for exclusion included: the respondent completed less than half the survey, the responses were inconsistent or conflicting, or the subject failed to answer the survey in a serious and systematic way. These 39 rejections left 192 responses for analysis, resulting in an 18% response rate.

Construction of the follow-up survey

The follow-up survey of actual users in the present research was modified from the instrument used in the first survey of all members, which necessarily included both actual and prospective users. The follow-up survey preserved the structure of the first survey. It was based in part on users' responses to the first survey, and also on the survey of Web users conducted by the Graphic, Visualization, & Usability Center (GVU) of the Georgia Institute of Technology (http://www.gvu.gatech.edu/user_surveys/).

Information technology adoption is not an end in its own right. Ultimately, information technology is adopted because it meets users' needs. The Web is growing at

an exponential rate, increasing from approximately 1,000 Web sites in early 1994 to roughly 100,000 in early 1996 (Clemente, 1998). Given such rapid growth and the relative immaturity of Web development technologies, it is unsurprising that many users report numerous usability problems in Web-based systems. The follow-up survey in the present study was designed to identify users' perceptions regarding the barriers to use of network services.

In the present research, the follow-up survey was modeled after the WWW User Surveys, conducted by the Graphic, Visualization, & Usability Center (GVU) of Georgia Institute of Technology (Georgia Tech, 1998). The GVU surveys are the premiere source of data regarding the usability problems of today's Web. The World Wide Web Consortium (W3C) standards development group, and INRIA, the acting European host for the W3C in collaboration with CERN, endorses the GVU survey (Georgia Tech, 1997). All survey results are public and available online.

For example, over 10,000 Web users participated in GVU's 8th WWW User Survey, which ran from October 10, 1997 through November 16, 1997, marking the culmination of four years of surveying the Web. The GVU survey has three sections: basic, special, and electronic commerce. The basic section includes general demographics, technology demographics, data privacy, and Web and Internet usage. The special sections include Web authors, Webmasters, and cultural issues. The electronic commerce sections include Internet shopping, information gathering and purchasing, and opinions on Internet commerce. The GVU question sets that related most closely to the present research were technology demographics, Web and Internet Usage, and

information gathering and purchasing.

Compared with Web survey results that rely exclusively on random dialed data collection, GVU's surveys show a bias toward greater experience, intensity of usage, and skill sets of the users. This bias was expected to also apply to the subjects of the follow-up survey used in the present research because the data about network use was not collected online. Not all of the respondents to the first survey who supplied a contact for follow-up were actual users of computer networks or information services at the time they responded during the year ended August 1996. If conducted over the Web, the follow-up survey would have been more likely to replicate the GVU survey bias toward experienced and skilled users. However, the research purpose was to include non-users who had the enabling technology in place at the time they responded to the first survey and who expressed an interest in using network services. The research risk with using a mailed survey was similar to relying on telephone interviews regarding Web use. The risk was that nonusers who were interested and equipped in 1995 or 1996 might still have been nonusers who "fudge up" in responding by mail to questions about their subsequent adoption and use of information services. This risk was acknowledged but was not expected to lessen the ability to generalize the results of the follow-up survey to all Red Angus cattle breeders who actually used network information services.

Terms from the technology demographics section of the GVU survey that were used in the follow-up survey of actual users were Web page creation and equipment upgrades. The GVU question in this section about equipment owned is covered in the first survey of the present study. Information technology in place in 1995 or 1996 was

known for all follow-up subjects except for one returned survey with a missing front page. Therefore, the GVU question about ownership was modified to inquire about equipment upgrades.

Terms and questions from the Web and Internet usage section that were added to the follow-up survey included most valuable general categories of online services and problems using the Web.

The initial survey did not address which specific applications the network was used for. In the follow-up survey, the terms Newsgroups and Usenet could have been added after the last term bulletin boards on the Information Sources used by Cattle Ranchers list of terms used in the first survey. In Bishop's survey, bulletin boards are not shown as a resource for obtaining information but as a network application. Bishop's question 7 asked about the value and use of computer networks according to the application used. The list of applications includes Email, bulletin boards, videoconferencing, and fax, among others. For purposes of the present study, Newsgroups/Usenet was listed as a service.

In Bishop's survey, specified network services were referred to collectively as network applications. In the GVU survey, the specified network services were referred to as Internet technologies. The term network applications is more accurately descriptive but may not serve as well as a heading for this question as does Internet technologies. The terms "online services" and "online forums" were considered for labeling this question in the present study and rejected in favor of the term "network services." The question was adapted from Bishop and GVU for the present follow-up survey as:

For all of the services that you currently use, please rank the importance of the following network services (1 is the most import, 8 is the least important):

Email
World Wide Web
File transfer (FTP)
Telnet
Gopher
Newsgroups/Usenet
Chat/Online discussion
Other (please identify)

The question used in the present study to ask about user problems using the Web is a duplicate of the relevant GVU survey question:

What do you find to be the biggest problems in using the Web?
(Please check all that apply).

Not being able to find the information I am looking for
Not being able to efficiently organize the information I gather
Not being able to find a page I know is out there
Not being able to return to a page I once visited
Not being able to determine where I am
Not being able to visualize where I have been and where I can go
It takes too long to view/download pages
It costs too much
Encountering links that do not work
Other

A term was added to the follow-up survey used in the present study to include product information on the list of "Types of Information Needed by Cattle Ranchers." The term supplier/vendor on the list of "Information Sources used by Cattle Ranchers" was retained from the initial survey used in the present research. Product information was specified for the present research because the GVU survey found it to be a less frequently accessed but popular type of information accessed on the Web. Only 6% of GVU survey respondents had never accessed product information on the Web.

Second survey of follow-up respondents

In June 1998, a follow-up survey was mailed to 41 respondents to the first survey who expressed a willingness to participate in follow-up research. All 41 follow-up subjects were using computer networks at the time of the first survey or were interested in using them. The purpose of the second survey was to answer research questions four and five about the perception of barriers to using electronic information services and the business impact of using computer networks. The instrument used for the follow-up survey is shown at Appendix D. Results of this second survey are discussed in Chapter 4.

Analyze and Integrate Collected Data

The first survey yielded three distinct types of data. First, users' perceptions of the value of information types and sources were gathered as ordinal data using four-point Likert scales. Second, users' desire for networked access to selected information was measured using a dichotomous yes/no answer. Lastly, questions regarding users' perceptions of barriers to adoption were gathered as free-form text entry.

Results from the first survey were collected and data were first coded for entry into SPSS. Results obtained from summarizing the raw data were given to the industry partner for their use in designing Web-accessible information services for their members.

Post hoc analysis was performed on demographic data to determine if the survey respondents were representative of the population of Red Angus breeders. Dimensions examined included herd size and geographic distribution.

The terms used by ranchers to describe barriers and advantages of technology adoption and network use were also analyzed. These procedures included frequency

counts of terms and grouping responses into constructs that were used to summarize respondent perceptions.

General survey data were analyzed with descriptive statistics, Chi-squares tests, t-tests, Spearman rank-order tests, and the Mann-Whitney U statistic.

CHAPTER 4

PRESENTATION AND ANALYSIS OF DATA

The first survey of the present study was mailed in August 1995 to 1067 ranching enterprises, comprising the entire membership of the Red Angus Association of America (RAAA). A total of 231 separate responses were received (22% of total surveys mailed), of which 192 responses (18%) were useable. 41 of the first survey respondents agreed to participate in a second survey which was mailed in June 1998. 18 separate responses (44%) were received to the second survey, of which 15 (37%) were useable.

Representativeness of the sample was assessed using two measures: herd size and geographic location. The reference group for both characteristics was the RAAA population as a whole. The ranching enterprises of survey respondents were found to be representative of the herd size and geographic dispersion of the ranches of the RAAA member population.

Results from the two surveys were analyzed using a variety of descriptive and inferential statistics. Findings are summarized below and discussed at greater length in the body of this chapter.

- Market-related types of information were the most valuable to cattle breeders.

- Personal sources of information were more valuable than group or impersonal sources.

- The desire for networked access to specific information varied directly with the perceived value of the type and source of information.

- Cattle breeders' perception of the importance of networked services was unrelated to their level of network experience.

- Computer network use at a location other than the ranch was unrelated to the adoption of computer networks at the ranch location.

- Respondents who used networked services in 1995 had not increased the total time they spent using networks at the time of the second survey in 1998.

- Problems that ranchers reported with using the Web directly paralleled the findings of Web user surveys conducted by Georgia Institute of Technology.

- The primary barriers to adoption of computer network technology were the opportunity costs of time and money. The primary factors that could have encouraged adoption were training and local telecommunications access to Internet service providers.

The success of networked systems for cattle ranchers and breeders depends first on knowledge of users' needs and habits, and ultimately on the value of network use to the ranching business. The extent of network use among widely dispersed rural business populations is largely unknown, even for groups with largely homogeneous information

needs. Likewise, the impact of networking on business outcomes among such populations is largely unknown.

The current research was undertaken to help shed light on the value of network use among one such dispersed rural business population, breeders of Red Angus cattle. This group shares a highly concentrated set of business information needs related to the breeding aspect of their business and a common need to market their product. With the increasingly widespread use of artificial insemination and embryo transfer, cattle breeders can also use networks to gain international trading opportunities.

All breeders of Red Angus cattle can be easily identified, because they must belong to a national association in order to qualify as registered breeders. This research was conducted as a cooperative venture between the researcher and the University of North Texas and the Red Angus Association of America (RAAA), both located in Denton, Texas. The RAAA functions primarily as an information service provider. The Association maintains a computerized registry of Red Angus breeding information that involves collecting data, processing it, and providing access to it. The RAAA provides communication media, chiefly by publishing a monthly trade magazine, the *American Red Angus*. From the industry partner's point of view, the purpose of the initial survey conducted in August 1995 was to estimate demand and preferences for a planned networked service offering.

The purpose of the second survey conducted in June 1998 was to learn about network use among the ranchers who, at the time of the first survey, were using networks

or had expressed an interest in using networks. The cover letter asking for a response from second-survey subjects was mailed over the RAAA president's signature. Results of the second survey were shared with the industry partner. This was the extent of involvement of the industry partner in the second survey. The second survey was conducted for research purposes to provide longitudinal comparison data, and to answer questions regarding the business impact of network use.

This chapter presents results from the first and second surveys, along with longitudinal comparisons between responses to the two surveys. Results from the first survey are used to assess breeders' interest in networks and factors associated with the adoption of computer networks. Results from the second survey are used to assess breeders' use of networks, to identify factors associated with the extent of that use, and to provide preliminary data on the impact of networking on the business of ranching. Longitudinal comparisons between responses to the first and second surveys include changes in the hours of network use, upgrades to networking equipment, and changes in the use of network services. Results are presented primarily with descriptive summaries, both quantitative and qualitative. Simple statistical analyses, Chi-squares, t-tests, Mann-Whitney U, and Spearman rank-order correlation coefficients were used to establish the degree to which noted differences are statistically significant.

Two primary surveys from outside sources were used to make comparisons between Red Angus cattle breeders and larger groups. These were surveys taken by groups at Cyber Dialogue (the FIND/SVP survey) and at the Georgia Institute of

Technology (the GVU survey). The FIND/SVP survey was used primarily as a basis of comparison for Internet user profiles or characteristics; the GVU survey was used primarily as a basis of comparison for Internet usage patterns and usage problems.

FIND/SVP survey data were gathered by the Emerging Technologies Research Group, formerly a division of FIND/SVP recently acquired by Cyber Dialogue Inc., an online market research firm. Beginning in 1994 with the American Information User Survey, the Emerging Technologies group has established itself as a reliable source of primary data regarding personal and business use of the Internet (http://etrg.findsvp.com). Internet users are defined in the FIND/SVP surveys as individuals currently using at least one Internet application besides email, such as the Web, file transfer, or Usenet.

GVU survey data used for comparison purposes was gathered by researchers at the Graphic, Visualization, & Usability Center (GVU) at the Georgia Institute of Technology (http://www.gvu.gatech.edu/user_surveys/). The GVU survey is endorsed by the World Wide Web Consortium (W3C). GVU surveys are acknowledged to show bias towards experienced and more frequent users, because GVU respondents are self-selected network service users. FIND/SVP findings are based on random samples and are used in the present study to augment GVU findings. The methodologies used in both surveys have acknowledged shortcomings.

<div align="center">Survey Results</div>

Presentation of survey results is organized around the five research questions that were the focus of the present study.

Research question one: What are the business information needs of Red Angus cattle breeders?

Research question two: What information technology do they use?

Research question three: What barriers and advantages do cattle breeders perceive to *adopting* computer network information technology?

Research question four: What barriers do cattle breeders perceive to *using* computer networks?

Research question five: What business advantages and disadvantages do cattle breeders perceive in using networked information services?

The first survey questionnaire, shown in Appendix B, and the second survey questionnaire, shown in Appendix D, were designed to answer these research questions. Results are presented by grouping survey questions according to the research questions they were designed to answer. Characteristics of respondents are discussed first, based on respondents' attitude about the importance of computer network services (question 9, first survey), herd size (question 10, first survey) and geographical location.

Research question one, regarding the business information needs of cattle breeders, was answered with summaries of types of information needed (question 4, first survey) and information sources used (question 5, first survey).

Research question two, regarding information technology, was addressed in part with responses regarding equipment ownership (question 1, first survey) and equipment upgrades (question 3, second survey). This research question also included investigation

into both the adoption of network services (questions 2, 3, and 6, first survey) and the use of network services (questions 4 and 6, second survey).

Research question three, regarding perceived barriers and advantages to adopting network services, was addressed directly with write-in responses (questions 7 and 8 first survey).

Research question four, regarding barriers to network use (as distinguished from barriers to network *adoption*), was addressed with a check off list of problems that network users experience (question 5, second survey).

Research question five, regarding business advantages and disadvantages of networked services, was addressed with the following: A Likert scale regarding the value of networked access to certain types of information (question 1, second survey), a Likert-scale regarding the value of networked access to certain sources of information (question 2, second survey), and two open-ended questions about the greatest advantages and disadvantages of using networked services (questions 7 and 8, second survey).

Research results are presented as outlined above to address research questions one through five. Throughout this presentation, findings will be interpreted and related to the set of expectations regarding results, comparisons between Red Angus cattle breeders and the general population, and expectations regarding comparisons of second-survey responses with first-survey responses. The sets of expectations regarding findings related to the five research questions are summarized, as follows.

- The most valuable types of information are market-related.

- Direct personal sources in the external environment are more valuable than groups or impersonal sources.

- Users' desire for networked access to a specific type of information varies directly with the perceived value of that information.

- Cattle breeders' perception of the importance of networks varies directly with increased experience.

- Computer network use at a location other than the ranch is related to the decision to adopt computer networks for use at the ranch location.

- If respondents used networked services in 1995, their use will have increased significantly at the time of the second survey.

- Problems that users report with using the Web will parallel the findings of the 8th GVU survey of 10,000 Web users.

Not all survey respondents answered all questions. In these cases, the number of good responses is noted and the data are presented as the percentage of respondents who did supply particular answers, rounded up to the nearest whole percentage point.

Characteristics of respondents

At the time of the first survey, the RAAA had 1600 members representing 1067 separate ranching operations. The initial questionnaire was mailed to all 1067 ranches, and 231 surveys were returned. Of the 231 returned, 39 were rejected for incompleteness or inconsistency, leaving 192 good responses. The sample size of 192 respondents

represented 18% of the population of all Association members as of the date the first survey was undertaken.

Of the 192 respondents who supplied good responses to the first survey, 41 agreed to participate in a second, follow-up survey. Of these 41 follow-up prospects, six subjects (or 15%) were no longer active cattle breeders, and nine did not return the follow-up survey. Of the 26 total respondents, 8 reported that they still were not using networked services as of summer of 1998. Of the 18 responses submitted as a result of the second survey, three were rejected for not meeting criteria for completeness, yielding 15 useable responses to the second survey.

Characteristics of first survey respondents

Characteristics of respondents to the first survey were examined primarily to determine if the sample of respondents was representative of the larger population of all registered Red Angus breeders. The primary characteristic used to assess representativeness was herd size, based on advice from the Red Angus Association management. The choice of herd size as the best single indicator for comparison of ranching operations was also based on accepted usage within the field of breeding and ranching. A second characteristic, geographic location, was also examined to help determine if the sample of prospects for the second survey was representative of the larger population of registered Red Angus breeders.

Responses to the first survey were received during the time period August 1995 to August 1996. Therefore, the two characteristics of herd size and geographic location of the respondents were compared with RAAA membership statistics as of year-end 1995.

Herd size of respondents to the first survey

Herd size was the primary characteristic used to compare first-survey respondents with the group of all Red Angus cattle breeders. Herd size is the factor used more than any other single characteristic to represent a cattle-breeding operation. Number of acres as a measure of the size of a ranching operation is unreliable because the amount of land necessary to support a herd varies so much from, say, the southeastern United States to the semi-arid mountain west. Nor are age or education of the ranch manager(s) or ranch employees necessarily reliable characteristics to use as a judge of representativeness, according to Red Angus Association personnel. Therefore, herd size was the primary characteristic chosen to judge how well the sample of 192 respondents represented the total number of 1067 Red Angus breeding enterprises. Table 4-1 summarizes herd size data for first-survey respondents.

Table 4-1.

Herd size of respondents to the first survey

Herd size	number of respondents	percentage of total
1-50	96	50%
50-100	46	24%
100-300	36	19%
over 300	13	7%
no answer	1	—
	192	100%

Average herd size was calculated by using the midpoint of the reported ranges for

size of total herd. Using this method, the average herd size was calculated to be 92 – 99

head, when the range of herd sizes of over 300 was allowed to vary from 350 to 450 head.

As of 1995 year-end, the average herd size of all member ranches as reported to the

RAAA was 100 head. This average herd size is reasonable and comparable with the

membership of other pure-breed associations, for which herd size is necessarily lower

than sizes of production herds.

Based on the average herd size of survey respondents, the sample of first-survey

respondents was judged to be representative of the population of Red Angus cattle

breeders as a whole.

Geographic location of respondents

A second characteristic of respondents used to determine the representativeness of

second-survey prospects was geographic location. The 41 second-survey prospects

represented twenty states within the United States; as of year-end 1995, RAAA

membership was distributed among 42 states in the U. S. It is inappropriate, given the

small n of 41, to make detailed proportional comparisons between members and survey

prospects on a state-by-state basis. However, eight of the top ten states by membership

were represented in the sample of 41 second-survey prospects. Furthermore, two of the

top three states with the most RAAA members were represented proportionately in the

sample. Based on these comparisons of geographical dispersion, second-survey prospects

were considered to be approximately representative of the RAAA membership.

Attitudes toward computer network services of respondents to the first survey

Red Angus members were asked about their attitude toward computer networks in

order to determine if their attitude varied with use and experience. Cattle breeders'

perceptions of the importance of networks were found to vary from the extreme of

believing that they will revolutionize ranching to the other extreme of believing they are

worthless. Table 4-2 summarizes first-survey subjects' responses to the following

question (question 9, first survey): Overall, how would you describe your reaction to

computer network services?

Table 4-2

Respondents' perceptions of the importance of networks

	Number of Responses	% of total	% of those with opinion
They could revolutionize ranching	22	11%	13%
They are useful in many respects	97	51%	59%
They are neutral or indifferent	40	21%	24%
They are not useful in many respects	6	3%	4%
They are worthless	1		
Missing responses	26	14%	—
	192	100%	100%

One of the expectations of the present study was that breeders who had more experience using computer networks would have more positive attitudes toward computer networked services. This expectation arose from the findings of LaRose and Mettler (1989) that positive attitudes were positively correlated with increased experience with computer-based information technologies over time. Two analyses were performed to determine if network use had an effect on attitude.

In the first analysis, subjects who used networks at the ranch at the time of the first survey were compared with subjects who did not use networks but who expressed an interest in doing so. Subjects who used networks were coded as Group 1 and ranchers who wanted to were coded as Group 2. A Mann-Whitney U test revealed no significant differences between the two groups. ($U=921$, $n_1=23$, $n_2=118$, $p > 0.05$)

In a second analysis, a rank-order correlation coefficient was computed based only on those respondents who reported using networks. In this analysis, length of time using networks was compared to overall perception. Contrary to the expectations of the researcher, the obtained value for the Spearman rho statistic was both negative (rho = - 0.225) and insignificant (n=22, $p > 0.05$).

<div align="center">Business information needs:</div>

<div align="center">What are the business information needs of Red Angus cattle breeders?</div>

For research question one, the business information needs of cattle breeders are summarized as types of information needed (question 4, first survey) and information sources used (question 5, first survey). Question 4 on the first survey was designed to learn which information types are most valuable to cattle breeders. The types of information listed on the survey were arrived at by identifying information needs arising from common business problems or opportunities of cattle breeders, as discussed in Chapters 2 and 3 of the present study. Subjects' responses to question 4 of the first survey are summarized in Tables 4-3 to 4-5.

Table 4-3

Summary of Importance of Information Types (Frequency)

Information Need	Missing	Perceived Value			
		1	2	3	4
Agricultural Chemicals	5	17	45	71	54
Auction Values	2	81	59	34	16
Breeding Information	4	157	25	4	2
Community Information	6	22	40	71	53
Education	7	72	68	26	19
Environment Regulations	6	23	51	66	46
Family Health	8	52	48	39	45
General Market Information	4	86	66	27	9
Government Regulations	8	26	56	58	44
Pest Management	6	28	56	56	46
Travel	11	12	32	57	80
Veterinary Information	2	81	68	32	9
Water Resources	9	22	43	55	63
Weather	8	70	54	32	28

Table 4-4

Summary of Importance of Information Types (% of Total Responses)

Information Need	Missing	Perceived Value			
		1	2	3	4
Agricultural Chemicals	3%	9%	23%	37%	28%
Auction Values	1%	42%	31%	18%	8%
Breeding Information	2%	82%	13%	2%	1%
Community Information	3%	11%	21%	37%	28%
Education	4%	37%	35%	13%	10%
Environment Regulations	3%	12%	27%	34%	24%
Family Health	4%	27%	25%	20%	23%
General Market Information	2%	45%	34%	14%	5%
Government Regulations	4%	13%	29%	30%	23%
Pest Management	3%	15%	29%	29%	24%
Travel	6%	6%	17%	30%	42%
Veterinary Information	1%	42%	35%	17%	5%
Water Resources	5%	11%	22%	29%	33%
Weather	4%	36%	28%	17%	15%

Table 4-5

Summary of Importance of Information Types (% of Valid Responses)

Information Need	Perceived Value			
	1	2	3	4
Agricultural Chemicals	9%	24%	38%	29%
Auction Values	43%	31%	18%	8%
Breeding Information	83%	13%	2%	1%
Community Information	12%	21%	38%	2%
Education	39%	37%	14%	10%
Environment Regulations	12%	27%	35%	24%
Family Health	28%	26%	21%	24%
General Market Information	46%	35%	14%	5%
Government Regulations	14%	30%	31%	24%
Pest Management	15%	30%	30%	25%
Travel	7%	18%	31%	44%
Veterinary Information	43%	36%	17%	5%
Water Resources	12%	23%	30%	34%
Weather	38%	29%	17%	15%

Space was left at the bottom of question 4 of the first survey for respondents to add

other types of information they access or want to access via networks. Types of

information written in by respondents included: agricultural organization information,

future or recent advances in animal care, EBB (electronic bulletin boards) for marketing

cattle, world and national news, financial information (both personal and ranch-related),

and range management information.

Information gathered from RAAA personnel and the findings of previous, related

research gave rise to the expectation that the most valuable types of information to cattle

breeders would be market-related. In the context of the present research, market-related

information is identified as breeding information, auction values, and general market

information. To determine if market-related information was perceived as more valuable,

survey responses were coded into two groups. Market related information types were

coded as Group 2, while all other information types were coded as Group 1. The two

groups were then compared using a Mann-Whitney U statistic, and market-related

information was found to be significantly more valuable than non-market related

information ($U=305460$, $n_1=2036$, $n_2=566$, $p < 0.0001$)

Breeding information, auction values, and general market information represented

three of the top four most important types of information. Market information is

interwoven with the nature and outcomes of the breeding business -- what Taylor (1987)

refers to as the client's information use environment. Taylor defines an information use

environment as the set of elements that determine the flow of information and the value

created in the process. Frank (1987) further defines the information needs of farmers and ranchers as primarily related to production and marketing. In the information use environment of cattle breeders, breeding information is as related to production as it is to marketing, in that the purpose of breeding for certain traits is to make the cattle more marketable. Therefore, as expected, the survey results confirmed what was predicted based on information use environment theory.

Meaningful analysis of a related question, whether perceived value of information was related to respondents' desire for network access to that information, required exclusion of certain survey respondents. Early on, it was noted that a substantial number of first-survey respondents (72 in all) expressed absolutely no desire for network access to any information, regardless of the type or source involved. Responses of these "technophobe" subjects represent a substantial confound to the results regarding the relationship between perceived value and desire for network access. These "technophobe" subjects were therefore excluded from this analysis.

The expectation that users' desire for networked access to a specific type of information would vary directly with the perceived value of that information was confirmed through statistical analysis of survey results. Table 4-6 shows how respondents who used networked services to access a given type of information or who wanted networked access, rated the value of various information types. For example, of the respondents who used or desired network access to breeding information, 91% of them rated breeding information as 1, that is, as being of high value.

Table 4-6

Perceived Information Value Among Users Desiring Online Access

Information Type	Perceived Value			
	1	2	3	4
Agricultural Chemicals	15%	40%	33%	12%
Auction Values	49%	33%	16%	1%
Breeding Information	91%	9%	-	-
Community Information	9%	31%	37%	23%
Education	55%	40%	4%	2%
Environment Regulations	15%	41%	35%	9%
Family Health	42%	31%	14%	14%
General Market Information	56%	34%	9%	1%
Government Regulations	21%	37%	33%	9%
Pest Management	25%	41%	25%	8%
Travel	17%	34%	20%	29%
Veterinary Information	49%	39%	10%	1%
Water Resources	14%	32%	32%	22%
Weather	52%	35%	11%	2%

In a second analysis of these data, a contingency table was created (shown in Table 4-7) in which desire for network access was compared with perceived value of various information types.

Table 4-7.

Contingency table: Desire for Networked Access by Perceived Value of Information Type

	Want Networked Access?	
Perceived Value	Y	N
1	70%	30%
2	55%	45%
3	40%	60%
4	20%	75%

The statistical significance of these results was assessed via a Chi-square test. The obtained Chi-square (45.11, df=3, $p < 0.001$) was statistically significant, indicating that users' desire for networked access to an information type is related to its perceived value. A Pearson contingency coefficient of .30 was obtained, confirming the expectation that users' desire for network access to a particular type of information correlates positively with its perceived value.

Determining the information needs of breeders included asking about sources as well as types of information. In question 5 of the first survey, association members were asked which sources of information are most valuable to them. The industry partner's purpose in asking this question was to identity sources of reference to be considered for inclusion in the Red Angus Association's proposed networked information system. Preferences for sources may influence links chosen for the Red Angus WWW site. The research purposes in asking this question were to identify valuable sources, to determine if personal sources are more valuable than organizational sources, and to determine if the value of the source of information is related to the preference for networked access to that source of information. Subjects' responses to question 5 of the first survey are summarized in Tables 4-8 to 4-10.

Table 4-8

Summary of Importance of Information Sources (Frequency)

		Perceived Value			
Information Source	Missing	1	2	3	4
Bulletin Boards	18	12	36	58	68
Customers	7	150	24	7	4
Extension Agents	11	46	58	48	29
Health Department	16	9	41	68	58
Industry Magazines	8	72	75	24	13
Libraries	17	11	35	78	51
Newspapers	12	30	61	56	33
Other Govt Agencies	16	5	29	60	82
Other Ranchers	10	82	72	22	6
Political Groups	18	3	23	42	106
Ranch Associations	12	35	75	51	19
Suppliers	10	52	72	43	15

Table 4-9

Summary of Importance of Information Sources (% of Total Responses)

| | | Perceived Value | | | |
Information Source	Missing	1	2	3	4
Bulletin Boards	9%	6%	19%	30%	35%
Customers	4%	78%	13%	4%	2%
Extension Agents	6%	24%	30%	25%	15%
Health Department	8%	5%	21%	35%	30%
Industry Magazines	4%	38%	39%	13%	7%
Libraries	9%	6%	18%	41%	27%
Newspapers	6%	16%	32%	29%	17%
Other Govt Agencies	8%	3%	15%	31%	43%
Other Ranchers	5%	43%	38%	12%	3%
Political Groups	9%	2%	12%	22%	55%
Ranching Associations	6%	18%	39%	27%	10%
Suppliers	5%	27%	38%	22%	8%

Table 4-10

Summary of Importance of Information Sources (% of Valid Responses)

	Perceived Value			
	1	2	3	4
Information Source				
Bulletin Boards	7%	21%	33%	39%
Customers	81%	13%	4%	2%
Extension Agents	25%	32%	26%	16%
Health Department	5%	23%	39%	33%
Industry Magazines	39%	41%	13%	7%
Libraries	6%	20%	45%	29%
Newspapers	17%	34%	31%	18%
Other Govt Agencies	3%	16%	34%	47%
Other Ranchers	45%	40%	12%	3%
Political Groups	2%	13%	24%	61%
Ranching Associations	19%	42%	28%	11%
Suppliers	29%	40%	24%	8%

One expected outcome of the present study was that direct personal sources of

information would be perceived as more valuable than group sources or impersonal

sources. In the context of the present study, personal sources were defined as customers,

suppliers, other ranchers and extension agents. Group sources were defined as ranching associations, county/state health department, other governmental agencies, and political alliance groups. Impersonal sources were defined as libraries, newspapers, industry magazines, and bulletin boards. Aguilar (1967) found that personal sources were more valuable to managers than impersonal sources. For managers, the most important personal sources were subordinates and customers, and the most important impersonal sources were publications such as trade magazines.

To determine if personal sources of information were more valuable to Red Angus cattle breeders, survey responses were coded into two groups. Personal sources were coded as Group 2, while the 11 other sources listed on the survey were coded as Group 1. The two groups were then compared using a Mann-Whitney U statistic, and personal sources were found to be significantly more valuable than non-personal sources ($U=269058$, $n_1=1419$, $n_2=730$, $p < 0.0001$).

The findings of the present research paralleled findings in the family of research studies most often referred to as computer-mediated communication. That is, personal sources were preferred by ranchers, as they are by workers in the fields of endeavor investigated in computer-mediated research, primarily engineers, business executives, scientists, and academics (Bishop, 1994; Drucker, 1995; Hiltz & Johnson, 1989; Frank, 1987). Ranchers' most preferred sources were other ranchers and customers.

One of the expectations of this research was that users' desire for networked access to a specific source of information would vary directly with the perceived value of

that source. This expectation was confirmed through statistical analysis of survey results.

Table 4-11 shows how respondents who used networked services to access the sources

specified, or who expressed an interest in obtaining networked access, rated the value of

particular information sources. For example, of the respondents who used or desired

network access to customers, 93% of them rated it as 1, i.e., high value.

Table 4-11

Value of networked access to information source

	Perceived Value			
Information Source	1	2	3	4
Bulletin Boards	6%	34%	41%	19%
Customers	93%	7%	-	-
Extension Agents	28%	47%	21%	4%
Health Department	6%	31%	54%	9%
Industry Magazines	40%	52%	8%	-
Libraries	6%	39%	39%	17%
Newspapers	16%	35%	42%	6%
Other Government Agencies	3%	30%	47%	20%
Other Ranchers	51%	40%	5%	4%
Political Alliance Groups	7%	21%	34%	38%
Ranching Associations	24%	55%	20%	2%

Suppliers   46%   42%   12%   -

In a second analysis of these data, a contingency table was created (shown in Table 4-12) in which desire for network access was compared with perceived value of various information sources.

Table 4-12.

Contingency table: Desire for Networked Access by Perceived Value of Information Source

Perceived Value	Want Networked Access?	
	Y	N
1	60%	40%
2	49%	51%
3	36%	64%
4	23%	77%

The statistical significance of these results was assessed via a Chi-square test. The obtained Chi-square (31.61, df=3, p < 0.001) was statistically significant, indicating that users' desire for networked access to an information source is related to its perceived value. A Pearson contingency coefficient of 0.26 was obtained, confirming the expectation that users' desire for network access to an information source correlates

positively with its perceived value.

Adoption of information technology:

What information technology do Red Angus cattle breeders use?

Research question two, regarding information technology, is addressed in part with responses regarding equipment ownership (question 1, first survey) and equipment upgrades (question 3, second survey). This research question regarding information technology also includes investigation into the adoption of network services (questions 2, and 3, first survey) and the use of network services (question 6, first survey and questions 4 and 6, second survey).

Information technology equipment in place

Equipment ownership

Members were asked what computer equipment they have in place, to determine the presence of enabling technology. The 192-member response was as follows:

117 IBM compatible computers (35% of the 192 respondents)

8 Macintosh computers (4%)

19 laptop computers (10%)

69 fax machines (36%)

54 CD-ROM drives (28%)

54 modems (for connecting a computer to the telephone network) (28%)

47 satellite dishes (24%)

One respondent wrote in the following reply: "We own one [presumably a computer] but have not got around to learn how to use it." Even though this respondent did not check any of the categories, this response was counted as one IBM personal computer. Eighteen of the laptop owners also owned PCs but there was no overlap between PC and Macintosh ownership. Therefore, a total of 125 ranches, or 65% of respondents, had at least one computer in place.

Equipment upgrades

Eleven (73%) of the 15 respondents to the second survey state that they had upgraded their computer equipment during the three year period beginning in mid-1995. How does this compare with broader groups of Internet users? According to GVU surveys, in April 1995, 50% of user respondents were using 14.4 Kb/sec modems or slower. In April 1998, only 4% of user respondents used 14.4 Kb/sec or slower modem speeds. This represents a 92% upgrade in modem equipment. Because speed is consistently cited as the biggest problem that users experience with the Web, modem connection speed is the only equipment usage tracked by the GVU surveys.

Adoption of network services

Research question two also includes investigation into the adoption of network services, addressed by questions 2 and 3 from the first survey. These questions asked breeders if they used computer network services on the ranch, how long they had used them, and why they started using computer network services.

<u>Number of breeders on the network</u>

Responses to the first survey showed that computer network services were used on 23 ranches, or 12% of subjects' ranch locations. By comparison, estimates derived from Clemete's (1998) data indicate that approximately 10% of U.S. households were at least occasional users of the Internet at the end of 1995.

<u>Years of network use</u>

Responses to the first survey were returned during the period September 1995 to August 1996. During this time frame, respondents who were users of computer network services reported that they had been users for an average of 18 months. The range of years of computer network use was from one month to five years, with a median use period of 12 months.

These survey results for Red Angus breeders parallel survey results for U.S. network users. The continued migration of users to the Internet was evident in the GVU's Eighth Survey (October 1997), where 36.62% of the users had gone online during the previous year. This percentage is higher than for the GVU survey taken April 1997 (25.34%), but is similar to results from the 6th survey (36.11%) taken October 1996. The most recent survey data from FIND/SVP (early 1998) likewise shows that more than 50% of all Web users (18.4 million) began using online services for the first time within the two year period from the end of 1995 through the end of 1997. This longitudinal data from both survey sources show the clear bump of when the Internet began to gain wide

acceptance in 1994 and 1995 and parallels the average use period of 18 months for cattle

breeders during the year ending August 1996.

Reasons for adopting computer network services

These computer network services users cited the following reasons for adoption:

getting up-to-date market information, fast access to information, the range of

information services available, sire directory information exchange with the Red Angus

Association and other cattle breed associations, education and "keeping up." Appendix E

contains survey respondents' verbatim reasons for adopting computer network

technology.

Relationship of network adoption at the ranch to network use at other locations

One of the expectations of the present study was that computer network use at a

location other than the ranch would be related to adoption of computer networks for use

at the ranch location.

To determine if computer use away from the ranch was related to the adoption of

networked technology at the ranch, subjects were asked to identify other locations where

they use computer networks. 82 respondents (43%) said at least one person from their

family or staff use computer networks away from the ranch. 39 of these 82 households

(48%) use computer networks at school or college, 62 (76%) at work locations other than

the ranch, nine (11%) at libraries, and four (5%) at other locations. A total of 26

households (32%) use networks at two or more locations. Of the 82 respondents who

reported using computer network services away from the ranch, 13 (16%) also used

network information services at the ranch location, while 10 reported using computer

network services *only* at the ranch location. A contingency table summarizing these

results is shown following.

Table 4-13

Contingency table: Use at Ranch by Use Away From Ranch

		Use at the ranch?		
		Yes	No	
Use away from the ranch?	Yes	13	69	82
	No	10	100	110
		23	169	192

A Chi-square analysis of these data was not statistically significant (Chi-square =

2.07, df=1, $p > 0.05$). Thus, the expectation that the use of network technology away from

the ranch would have a positive impact on the use of network technology at the ranch was

not supported.

Use of networked services

Research question two also includes the network applications and services used.

The use of network applications was addressed by question 4 from the second survey.

The use of networked services was addressed by question 6, from both the first and

second surveys. Responses to these questions will be discussed in turn.

To further investigate RAAA members' use of networked services, they were asked more specific questions than to rank the applications discussed above. Question 6 from the first survey asked breeders about which particular computer network services they had used and were asked to rank their value. Value rankings were on a scale of one to four, with one being the highest ranking. Responses from the first-survey respondents are summarized following.

Table 4-14.

Summary of Respondents' Perceptions of Networked Information Services

What network services are used?	Number of users	Mean perceived value
Red Angus Sire Finder	10	1.9
Internet	12	2.0
Red Angus Bulletin Board	7	1.9
America Online	11	2.1
CompuServe	9	2.0
Online library catalogs	6	2.0
Prodigy	8	2.0
AG*SAT	4	2.0
AGNET	3	2.3
AGRICOLA	2	2.0
AgriData Network	1	2.0
AGRIBUSINESS U.S.A.	0	n/a
USDA Online	2	2.5
The Source	0	n/a
Other (Farm/Dayta)	1	2.0

Question 6 from the second survey was used to inquire about Web site use. Table 4-15 summarizes subjects' responses regarding Web site use.

Table 4-15

Summary of Web Site Use by Second-Survey Subjects

Service	Number of users
The Red Angus Association	14
Other cattle associations	10
The Livestock Virtual Library	4
Chicago Mercantile	6
Beef Home Page	5
Cowman's Choice	1
Industry Journal Abstracts	0
Beef Today	3
Livestock Plus	2
National Agriculture Library	0

Use of network applications

In question 4 of the second survey, subjects were asked to note the network applications they use and to rank the importance of these network services. Responses from the fifteen second-survey respondents are summarized in Table 4-16.

Table 4-16

Summary of Internet Applications Used by Second-Survey Subjects

Network application	Number of users
Email	14
World Wide Web	15
File transfer (ftp)	11
Newsgroups/Usenet	6
Gopher	7
Telnet	6
Chat/Online discussion	4

Hours of computer network use

Those respondents who use network services report that a average of 10% of a typical workweek was spent using computer network services at the time of the first survey. However, these data are skewed because one respondent who writes ranch

management software reports spending 50% of his time using networked services. The median time spent online was 5% of the typical workweek and the mean time was 8%.

The FIND/SVP survey found that new users spend less time online than more experienced users, but that their frequency and length of online sessions increases with increased use. GVU survey findings also consistently report this effect, that is, that respondents who have been online for more years tend to spend more hours using the Web, but they also report that statistically, the relationship is still fairly weak.

One of the expectations of the present study was that if respondents used networked services at the time of the first survey, their use would increase by the time of the second survey. Thus, the question regarding respondents' percentage of the workweek spent accessing and using networked information services was repeated in the second survey.

This expectation of increasing use was not borne out by survey results. Only eight second-survey respondents had been actual network users at the time of the first survey. The percentage of the workweek spent using networked services was compared across the two surveys for these eight subjects. Although the average percentage of the work week spent using network services increased to 12%, a t-test showed that this increase was not statistically significant ($t = .45$, df $= 7$, $p > 0.05$).

Barriers to adoption:

What barriers and advantages do cattle breeders perceive to adopting computer

network information technology?

Research question three, regarding perceived barriers and advantages to adopting

network services, was addressed directly with write-in responses to questions 7 and 8 of

the first survey used in the present study. These two questions ask about the pros and

cons of getting connected to the network. The business assumption underlying these

questions is that decisions about information technology adoption are based on

respondents' assessments of opportunity costs and related benefits. Question 7 in the first

survey of the present study is "What do you think are the three biggest barriers to using

network services?" Question 8 from the first survey is "What are the three most

important factors that encouraged your use of network services, or that could encourage

your use?"

The evaluation of pros and cons is the basis of cost/benefit analysis. The goal of

analyzing costs and benefits is to weigh decision factors until an overall return on

investment can be estimated. The usual monetary-based cost vs. benefit analysis can be

further conceptualized as a process of weighing opportunity costs, opportunities, and

making an overall assessment of the value of both tangible and intangible decision

factors. For purposes of the present study, it was assumed that those RAAA members

who believed the overall return was justified on the time, effort, and money required to

adopt network services, did indeed adopt these services at the time of their reply to the

first survey. Open responses to questions 7 regarding factors that discourage network

adoption and open responses to question 8 regarding encouraging factors are summarized

with representative responses, as follows.

<u>Perceived barriers to adoption of computer network services</u>

<u>Factors that discourage network use: Summary of open responses</u>

Numbers in parentheses indicate the number of items coded in each category. Examples

of responses are shown in italics.

Cost barriers (98 responses)

Purchasing the technology to gain access

Fear of costs associated with network service

Hidden cost, purchase of extra material

Knowledge barriers (76 responses)

Not aware of what is available and what it will do for us

Hesitancy because of lack of knowledge

Learning how and when to use it

Don't have many chances to learn about computer or network services

Someone to take the time to teach how to use the services and computer

Time barriers (32 responses)

Too busy working for a living

Would have to spend too much precious time to learn

I barely have time to cover the essentials

Access barriers (30 responses)

> (Lack of) availability (9 respondents used this single term)
>
> Our biggest problem in northwest MO is our phone company (the
>
> connections are poor, costs, etc.)
>
> The only barrier I have is there is no local access number-everything is
>
> long distance!
>
> Because of our location we have an old communication system (RT
>
> Communications) with a min-max 2400-baud. We cannot access some
>
> systems.

Network utility concerns (25 responses)

> Getting everyone connected
>
> Lack of organization of the Internet
>
> Too many of the ranchers do not comprehend or are willing to become
>
> involved with computers.
>
> Small ranch, don't need to go to the computer

Information utility concerns (21 responses)

> Amount and type of information not always relivant (sic)
>
> Bad info and no info. I am not impressed with these services.
>
> (Need) useable information

Motivational barriers (17 responses)

> Getting started

Fear of the unknown

I am too old for the computer to change me. I don't like change

Not interested

Security concerns (5 responses)

Not sure about the privacy of use

Virus potential

Perceived advantages to adoption of computer network services

Factors that encourage network use: Summary of open responses

Numbers in parentheses indicate the number of items coded in each category. Examples

of responses are shown in italics.

Network utility (45 responses)

Easy access to information

Making Red Angus available to others

Convenience

This is especially important in isolated areas

Need for email and file transfer

Information utility (25 responses)

Availability of large volumes of information with search capabilities

Useful information

Amount of information available. New advances in technology.

Education dealing with the industry

Good source of information

Time advantages (19 responses)

Speed, turnaround time

Up to date information

Rapid availability of services

One respondent said the factor that encourages him to use networked services is "fun." This response is not categorized in the list shown above. Two other responses defied categorization, the first was "very good" and the second was "Defeat Clinton? Homo's. Baby killers".

Barriers to use:

What barriers do cattle breeders perceive to using computer networks?

Research question four, regarding barriers to use (as distinguished from barriers to adoption), is addressed with a check off list of problems (question 5, second survey). Question 5 was: "What do you find to be the biggest problems in using the Web?" Respondents were asked to check all that apply from the list of suggested problems. Table 4-17 summarizes these results.

Table 4-17

Summary of Usage Problems Encountered by Second-Survey Subjects

9	It takes too long to view/download pages
9	Encountering links that do not work
9	Not being able to find the information I am looking for
5	Not being able to efficiently organize the information I gather
4	Not being able to find a page I know is out there
3	Not being able to return to a page I once visited
1	Not being able to determine where I am
3	Not being able to visualize where I have been and where I can go
0	It costs too much
1	Other

An expectation of the present research was that survey respondents' problems using the Web would parallel the problems reported in recent GVU surveys of Web users. Comparative analysis showed that results of the follow-up survey were directly comparable to the Ninth GVU survey, conducted in April 1998. In the GVU surveys, speed is consistently reported as the number one problem for Web users. After slowness, the next most frequently cited problem in the Ninth GVU survey was broken links, also

known as "linkrot." The next most frequently cited problem was not being able to find information.

These were also the top three problems cited by RAAA members. For purposes of this analysis, frequency of report was converted into rank. The results are summarized in Table 4-18.

Table 4-18

Comparison of Second Survey Responses to GVU Results

Problems using the Web	GVU Rank	RAAA Rank
It takes too long to view/download pages	1	2
Encountering links that do not work	2	2
Not being able to find the information I am looking for	3	2
Not being able to efficiently organize the information I gather	5	4
Not being able to find a page or Web site I know is out there	4	5
Not being able to visualize where I have been/where I can go	7	6.5
Not being able to return to a page I once visited	6	6.5
Not being able to determine where I am	8	8

A Spearman rank-order correlation coefficient was computed between the relative rankings of the various problems on the two surveys (Ninth GVU and the follow-up

survey in the present study). The obtained rho was statistically significant (rho = 0.945, n=15, p < 0.01). Therefore, the expectation that the usability problems encountered by respondents to the second survey of the present study would parallel those reported by GVU respondents was confirmed.

Use of the Web by cattle breeders:

What business advantages and disadvantages do cattle breeders perceive in using networked information services?

Research question five, regarding business advantages and disadvantages of networked services, is addressed via multiple elements in the second survey. These elements include two Likert-scale questions regarding the business impact of networked access to certain types and certain sources of information (questions 1 and 2, respectively, second survey), as well as two open-ended questions about the greatest advantages and disadvantages of using networked services (questions 7 and 8, second survey).

Business impact of networked access to types of information

Based on first-survey responses, three new types of information were added to the second survey: conservation, tax planning, and estate planning. These items were believed to represent a sixth business problem, succession of ownership and land use planning. Tables 4-19 to 4-21 summarize subjects' responses regarding business impact of network access to various types of information.

Table 4-19

Summary of Business Impact of Network Access to Information Types. (Frequency)

Information Type	Missing	Perceived Value				
		1	2	3	4	5
Agricultural Chemicals	2	2	11	-	-	-
Auction Values	1	4	6	4	-	-
Breeding Information	2	2	8	3	-	-
Environment/Conservation	0	3	1	2	9	-
Estate Planning	2	1	1	11	-	-
General Market Information	4	8	-	3	-	-
Government Regulations	0	2	1	1	11	-
Pest Management	2	5	7	1	-	-
Product Information	1	2	5	7	-	-
Taxes	2	1	3	9	-	-
Veterinary Information	2	2	6	5	-	-
Water Resources	3	-	1	11	-	-
Weather	1	4	7	3	-	-

Table 4-20

Summary of Business Impact of Network Access to Information Types

(% of Total Responses)

Information Type	Missing	Perceived Value				
		1	2	3	4	5
Agricultural Chemicals	13%	-	13%	73%	-	-
Auction Values	7%	27%	40%	27%	-	-
Breeding Information	13%	13%	53%	20%	-	-
Environment/Conservation	20%	7%	13%	60%	-	-
Estate Planning	13%	7%	7%	73%	-	-
General Market Information	0%	27%	53%	20%	-	-
Government Regulations	13%	7%	7%	73%	-	-
Pest Management	13%	-	33%	47%	7%	-
Product Info	7%	13%	33%	47%	-	-
Taxes	13%	7%	20%	60%	-	-
Veterinary Information	13%	13%	40%	33%	-	-
Water Resources	20%	-	7%	73%	-	-
Weather	7%	27%	47%	20%	-	-

Table 4-21

Summary of Business Impact of Network Access to Information Types

(% of Valid Responses)

| | Perceived Value | | | | |
Information Type	1	2	3	4	5
Agricultural Chemicals	-	15%	5%	-	-
Auction Values	29%	43%	29%	-	-
Breeding Information	15%	61%	23%	-	-
Environment/Conservation	8%	17%	75%	-	-
Estate Planning	8%	8%	85%	-	-
General Market Information	27%	53%	20%	-	-
Government Regulations	8%	8%	85%	-	-
Pest Management	-	38%	54%	8%	-
Product Info	14%	36%	50%	-	-
Taxes	8%	23%	69%	-	-
Veterinary Information	15%	46%	38%	-	-
Water Resources	-	8%	92%	-	-
Weather	29%	50%	21%	-	-

Business impact of networked access to sources of information

The first survey used in the present study specified 12 business sources of information for cattle breeders. However, due to the lack of interest in political alliance groups expressed by respondents to the first survey, this source was dropped from the second survey's list of specified sources. The remaining eleven sources were specified with exactly the same terms in the second survey as in the first. Tables 4-22 through 4-24 summarize subjects' responses regarding business impact of network access to various information sources.

Table 4-22

Summary of Business Impact of Network Access to Information Sources

(Frequency)

		Perceived Value				
Information Source	Missing	1	2	3	4	5
Bulletin Boards	1	4	4	6	-	-
Customers	2	3	4	6	-	-
Extension Agents	3	3	2	7	-	-
Health Department	2	3	10	-	-	-
Industry Magazines	0	3	7	5	-	-
Libraries	2	2	3	8	-	-
Newspapers	2	3	4	6	-	-
Other Govt Agencies	2	2	3	8	-	-
Other Ranchers	1	2	9	3	-	-
Ranching Associations	1	1	6	7	-	-
Suppliers	2	3	4	6	-	-

Table 4-23

Summary of Business Impact of Network Access to Information Sources

(% of Total Responses)

Information Source	Missing	Perceived Value				
		1	2	3	4	5
Bulletin Boards	7%	27%	27%	40%	-	-
Customers	13%	20%	27%	40%	-	-
Extension Agents	20%	20%	13%	47%	-	-
Health Department	13%	0%	20%	67%	-	-
Industry Magazines	0%	20%	47%	33%	-	-
Libraries	13%	13%	20%	53%	-	-
Newspapers	13%	20%	27%	40%	-	-
Other Government Agencies	13%	13%	20%	53%	-	-
Other Ranchers	7%	13%	60%	20%	-	-
Ranching Associations	7%	7%	40%	47%	-	-
Suppliers	13%	20%	27%	40%	-	-

Table 4-24

Summary of Business Impact of Network Access to Information Sources

(% of Valid Responses)

Information Source	1	2	3	4	5
Bulletin Boards	29%	29%	43%	-	-
Customers	23%	31%	46%	-	-
Extension Agents	25%	17%	58%	-	-
Health Department	0%	23%	77%	-	-
Industry Magazines	20%	47%	33%	-	-
Libraries	15%	23%	61%	-	-
Newspapers	23%	31%	46%	-	-
Other Government Agencies	15%	23%	61%	-	-
Other Ranchers	14%	64%	21%	-	-
Ranching Associations	7%	43%	50%	-	-
Suppliers	23%	31%	46%	-	-

In summary, the results of the two surveys, based on an approximately

representative sample of Red Angus cattle breeders, paint an interesting picture. Several

research expectations were confirmed. First, Red Angus cattle breeders perceive market-

related types of information to be inherently more valuable than non market-related

information. Second, Red Angus breeders have a preference for personal sources of information as compared to non-personal sources. Third, ranchers' desire for networked access to various information types and sources is positively correlated to the perceived value of those types and sources. Lastly, problems that ranchers reported with using the Web directly parallel the findings of Web user surveys conducted by Georgia Institute of Technology.

Three research expectations were not confirmed. No relationship was found between breeders' level of network experience and their perception of the importance of networked services. Second, computer network use at a location other than the ranch was unrelated to the adoption of computer networks at the ranch location. Lastly, respondents who used networked services in 1995 had not significantly increased the total time they spent using networks at the time of the second survey in 1998.

Narrative responses to open-ended questions suggest that opportunity costs of time and money constitute the primary barriers to adoption of computer network technology among respondents. The primary factors that could have encouraged adoption were training and local telecommunications access to Internet service providers.

CHAPTER 5

DISCUSSION

In this chapter, research results are summarized, related to each other, and related to a larger context. This summary of results focuses on the three primary areas of investigation undertaken in the present research. Summarized first are the barriers and advantages to accessing networked information, as perceived by Red Angus cattle breeders. Second, the business impacts of using networks are reviewed for this group. Third, problems related to network use are discussed.

Barriers to adopting networked information technology

One of the more surprising results presented in Chapter 4 was that Red Angus members did not lag significantly behind the general population in terms of their adoption of network services as of 1995, raising the intriguing possibility that these breeders may represent "early adopters" among their rural cohorts. Still, several patterns emerged from subjects' answers to the open-ended questions on the first survey, regarding barriers to adoption of network information services.

The costs of equipment and telephone access charges were mentioned most often. Several members said that local telephone access (no long-distance charges) was the main

factor that could encourage their use of computer networks. Similarly, the time and effort required to learn how to use the computer was frequently cited as a barrier to adoption, especially the lack of access to know-how or training. As one rancher summed it up, "there is no easy way to get started." The time required to find good information even after the rancher was up and running was cited as a drawback by several network users.

Economic models typically operate from the assumption that resource allocation decisions are based on expected value of outcomes, or what financial analysts call overall return on investment. In the case of network use, the investment involves a commitment of time, money, and effort.

Not surprisingly, these are precisely the barriers to network adoption most frequently cited by respondents to the first survey of the present study. Furthermore, many respondents cited the unavailability of help in getting started as a particularly discouraging factor in installing a computer and learning to use the network. In the case of computer adoption, cattle breeders are further outside their areas of expertise than in adopting, say, rotational grazing, riverside conservation measures, or artificial insemination techniques. Particularly noteworthy in this regard was a write-in comment by one rancher, who said, "We need more of a inside org/outside org to assist the smaller breeders in marketing cattle. Advertising is a big expense for us with no results!"

To compound the difficulties of getting started, the ranchers have less expertise to draw upon from their traditional sources of support, such as cattle breed associations and extension service agents. One unexpected finding of the present study was the relatively

low ranking of the Red Angus Association itself as a valued source of information. One possible explanation may be found in the very high turnover rate among RAAA personnel. Of the ten people the researcher met in the summer of 1995, only two were still employed as of December 1998 and they were employed in different capacities. Most importantly, the person who answered most of the ranchers' direct requests or fielded their inquiries had left the association, apparently without having trained a successor.

Of course, ranching support organizations are themselves struggling to adopt and effectively use computer technology. Also, the traditional mission of these support organizations has been to help practitioners implement research ideas and findings from land-grant colleges and governmental laboratories. These organizations have no precedent for helping their constituencies adopt general-use information technologies.

Another unexpected finding regards the relatively low ranking of extension agents and other government agencies. This low ranking may be attributable to ranchers' belief that these sources are more impersonal than they were in the past. As one rancher put it, "Hell, they [extension agents] used to be helpful, but now the government's got them pretty much tied up with red tape."

Finally, there is the "Catch 22" issue of network use by cattle breeders. The lack of widespread use of networks across the larger cattle industry has limited the willingness of the necessary industry players to make a substantial commitment to networking technology. The longer-term expected increase in ranching constituencies such as

suppliers, customers, and other ranchers with a trading presence on the network is what several respondents said they were waiting for.

The ranchers have thus accurately identified the general market expectation that, as in previous years, the costs of networking will continue to drop in terms of money spent on computer tools and access charges and that time requirements will decrease as networks become easier to use. Similarly, the general market expectation is that the return on money, time, and effort invested in networking will grow as the number of users continues to grow. This is particularly true for any group that needs a "quorum" of buyers and sellers in the same market before network use can become an effective tool. Further, this holds even truer for such specialized businesses as cattle breeding.

The corollary to the question of barriers is the question of advantages to adopting network technology. From a research point of view, the primary long-term advantage computer networks potentially offer for cattle breeders is the ability to market their product more effectively and to a wider audience. The potential for the greater effectiveness of Web-based marketing arises from several reasons, primarily reduced cost and the ability to reach many more potential customers than have been reached in the past through traditional word-of-mouth and magazine advertising. In 1995 at the time of the first survey, the RAAA (Red Angus Association of America) had 1600 individual members of whom a total of 26 were from Canada, South America, and Australia. These foreign members presumably belong to an U. S. registry in order to sell into the U. S. market. Most Red Angus breeders advertise primarily through the *American Red Angus*

magazine published ten times annually by the RAAA. This magazine has 7,000

subscribers. About 5,000 are customers, as distinguished from members or trade

suppliers. In other words, most of the readers of the *American Red Angus* are in the

market for Red Angus cattle, semen, or embryos. For members, one full color, full-page

advertisement in this magazine costs $850. Comparatively, Web-based marketing has

much to offer, even beyond reduced cost and wider reach. Web sites have the potential to

offer more information than magazine advertisements, allowing customers to follow links

within a Web site of a breeder's offerings that particularly interest them. E-mail saves

potential customers the cost of telephone charges for inquiries and provides breeders an

inexpensive, quick means of staying in touch with customers throughout the course of a

sales transaction. Additionally, use of electronic cash in the near future may allow cattle

breeders to sell as well as market via computer networks.

However, the advantages of adopting computer networks for marketing purpose

were scarcely recognized or acknowledged by many breeders at the time of the first

survey in 1995. The advantages to adopting network technology most often cited by

RAAA members in 1995 were the quality and quantity of information available and the

speed and convenience of using online services. At the time of the follow-up survey in

1998, only three of the fifteen respondents had created Web sites for their ranch, despite

the fact that all of them said that they had considered the advantages of using the Web to

advertise. Similarly, Red Angus Association personnel estimate that fewer than 20 of

their members have established a Web site for their ranch, equivalent to only about 2% of

the number of separate ranching enterprises as of September 1998.

Business impacts of using networked services

The present study investigated the role networks played in addressing information

needs arising from typical business problems faced by cattle breeders. The Red Angus

Association of America (RAAA) now provides online access to the library of sire

directories they maintain. The directory allows users to search the sire database to find

the expected progeny difference statistics (EPDs) of a registered Red Angus bull that

meets the criteria needed to improve their particular herd. The RAAA Web site also

provides back copies of the *American Red Angus*. The RAAA's eventual purpose for their

Web site is to include links to information that address business problems and

opportunities of Red Angus breeders and to provide an online marketplace for Red Angus

cattle, embryos, and semen. Plans for further development include an interactive trading

post, with a bulletin board and a searchable multimedia database of sire prospects that

includes photographs or video clips as well as statistics for each bull.

Value vs. business impact of information types and sources

The first survey used fifteen terms to describe information needs, which included

family matters such as travel, health, and education. From the set of fifteen terms used in

the original survey to describe types of information needs, the second survey employed a

core set of ten terms most closely related to ranchers' business: breeding information,

auction values, general market information, veterinary information, agricultural

chemicals, pest management, water resources, environmental regulation, weather, and governmental regulations.

In the first survey, ranchers were asked to rate the value of information types. In the second survey, a subset of these ranchers was asked to rate the impact, that is, the value to their business, of using networked access to the core set of ten types of business information. Surprisingly, the business impact of having networked access was typically rated as less valuable to the rancher than the intrinsic value of the information itself, across multiple types and sources of information. There were relatively few cases for which ranchers rated the value of networked access at a higher level than the rating of information value. In these cases, the positive rating typically was for low value information needs such as agricultural chemicals and environmental regulations.

Problems related to network use

The information needs of cattle breeders, although tightly shared within this specialty profession, can be assumed to vary considerably from the information needs of other professions, even other agricultural specialties. However, an interesting outcome of the present research was that although information needs may be particular to a specified business, problems with using networked services are widely shared.

Findings regarding cattle breeders' problems with using networked information services, particularly the Web, directly paralleled the findings of larger surveys of heterogeneous users, such as the GVU and FIND/SVP surveys used for detailed

comparisons in Chapter 4. Furthermore, the findings of these online and random direct-dial surveys have remained essentially consistent since 1995.

Summary

The present study contributes to several literatures, including rural technology adoption and information use environments. As part of the literature on rural technology adoption, the findings of this study can probably be generalized to the wider population of breeders of all strains of cattle, not just Red Angus breeders. Cattle breeders are a fairly homogeneous, albeit geographically scattered, group. They face a core set of information problems associated with breeding, record keeping, and marketing. Their business operations are rural, yet they have increasing access to international trading opportunities.

The literature regarding information use environments typically focuses on technical users, such as scientists, academics, and engineers, rather than geographically dispersed rural populations. Also, many of these studies were conducted prior to the advent of the World Wide Web. The Web, by creating a common access protocol used worldwide, changes the nature of research into the role of networks, because it removes networking from the restrictions of special networks for particular groups. The present longitudinal study began in August 1995 with the first survey and concluded in August 1998 when all possible responses to the second survey had been collected. This period of time was one of steady influx of small business users to the public computer networked community. However, results of the present study show that even those who were using

networked information systems were not taking advantage of their marketing potential,

by their own admission. The full business impact of information technologies may not be

recognized for the cattle breeding business and other segments of rural industries until

networked information services are understood as being useful for sending information

out as well as bringing information *in.*

CHAPTER 6

FUTURE RESEARCH AND CONCLUSIONS

In this chapter, questions for future research are suggested and the potential

advantages of applying the approach used in the present study to the beginning stages of

system design are discussed. To conclude, implications of research results for technology

diffusion theory are explored.

Suggestions for future research

A question not addressed in the present study was to determine if the adoption

rate of networking technology among the study group was a function of the nature of

their business or a function of some other factor or factors. It would be interesting in

future to match two equally homogeneous, equally dispersed rural populations and

compare rates of computer technology adoption and use based on their information use

environments.

Much adoption of innovation research looks only at acquisition of new

technology or procedures. Based on the frustrations expressed by many of the survey

respondents in the present study regarding network use, it would be interesting to see

how many early adopters later abandoned or reduced their use of the Web in favor of

more traditional media. This could be accomplished by using the statistical method of

survival analysis, and could be applied equally well to much larger groups for which initial adoption rates are known.

A suggested area for future research is to assess the effect the Internet has on trading patterns for widely dispersed rural populations. For example, international trading opportunities opened up for cattle breeders with the development and refinement of artificial insemination and embryo collection, packaging, and shipping techniques. Until the advent of the Web, however, the difficulty of locating up-to-date information upon which to base sire selection was a distinct barrier regardless of location, both within and among breeder and producer communities. Although only one respondent to the second survey used in the present study mentioned communication with international customers as a benefit of using the Web, it will be interesting to learn how trading patterns play out in the future now that all the enabling technologies are in place.

As of mid-year 1998, many major American cattle breeding associations have made their members' sire statistics available and searchable, to at least some degree, over the Web. All these breed associations, however, are national rather than international. This, quite obviously, presents an ease-of-use information barrier to international trade. Prospective purchasers must currently search multiple national association sites to locate the best qualified sire for their particular herd, rather than searching an international database once for sires or embryos from any location. An interesting prospect for future research would be to test for relationships between growth of particular cattle breeds as a percentage of total production and prospective international alliances formed by breed associations to make sire information more easily accessible worldwide.

Currently, the Web is almost exclusively an extension of existing sources and types of information. In the future, certain kinds of information may only be accessible via an integrated audio/visual network. An example that pertains to the business of breeding cattle is the ability to watch video of a potential sire in order to judge gait, temperament, and other criteria. This will potentially be a great benefit to breeders who provide artificial insemination. The sophisticated set of criteria used to arrive at EPD numbers are reliable, valid, and widely understood. Ranchers will want access to and will use EPDs in their decision-making process even if the prospective sire is just across the fence. However, an interesting question to ask in the future is "What impact on the sire owner's business does providing visual and audio information have beyond providing EPD data alone?"

Implications for system design

The present research may also prove to have implications for system design. An ongoing problem for system designers is the difficulty users have in explicating their needs and uses for information. This explication is traditionally the beginning phase of system design, referred to as the user requirements definition phase. The present study suggests an alternative design model, in which designers seek first to understand users' business problems and information use environments as a precursor to specifying user requirements during system conceptualization.

A clear understanding of user requirements is a necessary condition for users' satisfaction with resulting systems (Martin, 1985). To overcome the initial hurdle of the understanding gap between users and designers, an approach known as rapid application

prototyping, or RAP, has come into widespread use. The idea behind this approach is that users find it much easier to communicate what they need when given the opportunity to interact with a prototype of a prospective system. The how-to literature about the RAP process is abundant. However, the step that remains blurry or is sidestepped altogether is a method for designers to use to better approximate the ideal system with the first iteration of the prototype.

The survey to establish user requirements used in this research might be helpful in this regard. The research approach used in the present study assumes that the best way for system designers to specify the requirements of users is to understand user problems that give rise to user needs.

Rather than asking users to describe a useful system for online access to information and for trading information with relevant constituencies, the survey asked only that users rank types and sources of information in order of importance. The types and sources of information considered important enough to ask about were arrived at by identifying the kinds of problems that arise from the nature of the user's business. This approach places the responsibility with the designer for getting familiar with the users' business, rather than assuming that users can explicate processes which to them may be so familiar as to "go without saying." This method of defining user requirements may be especially useful for system innovation or for users who have not previously relied upon computerized systems. For new systems or new users, it is easier for designers to ask about present and prospective business problems than to ask users to define a system that

provides solutions. This approach allows the user to think in business terms and the designer to think in terms of technology solutions to business problems.

Theoretical implications

It is interesting to note that RAAA members' responses to the question regarding the factors that encourage or could encourage adopting networks are quite different from responses regarding the advantages of actually using networks. No respondent to the second RAAA survey cited "It costs too much" as a problem with using the Web, yet cost, including ongoing costs and connection costs, were the the most frequently cited barrier to adopting network technology. This finding was one indication that barriers to adoption were perceived as being separate from problems encountered during actual use of networked computer technology.

This distinction may be important because adoption and use are frequently spoken of as essentially the same thing, especially in sociology literature. Indeed, adoptions of innovations that involve changes in perception or changes in practice have an inseparable use component in many cases. This is especially true in agriculture where examples abound, including crop rotation, pest control, and the adoption of artificial insemination techniques for breeding animals. The adoption and use aspects of these innovations can not be separated. However, subjects included in the present study perceived the adoption and use of information technology to be separate issues.

Does the diffusion of information technology differ in some important way from older technologies? This question is outside the scope of the present study but its dimensions are outlined here as possibilities for future research related to diffusion

theory. To begin, technology diffusion is defined here to include more than the initial adoption of a new technology. Once a new technology is adopted it must still be integrated with existing work patterns and other technologies to "take hold." Unlike previous agricultural technologies that could be classified as a product, a practice, or a service, information technology crosses all these categories and has social implications as well. The adoption of information technology is multi-faceted in other ways; the enabling physical equipment must be purchased, the purchaser must install and learn how to use the equipment, purchase the enabling software and connections, learn how to access available services, and learn how to incorporate information products and services into the business.

Thus, information technology presents a complex series of events that must take place and skills that must be mastered to implement it. And this is only the beginning. The technology must then be used to retrieve information, present information, or communicate with others. Only at this stage of the process can the user evaluate the business impact of having "adopted" information technology.

The classical theoretical approach to technology diffusion considers awareness, interest, evaluation, trial, and adoption (Rogers, 1995). This model inadequately accounts for problems with use or for the rejection of technology after it has been adopted. Statistics from the FIND/SVP surveys of Internet users (Clemente, 1998) indicate that of the 48.6 million people who went online using at least one application other than email during the year 1997, 25% (12.3 million) had tried the Internet but did not consider themselves users at the end of 1997. This churn rate compares favorably

with other information services, such as the 30-40% annual churn rate for cable TV service, but it is certainly an important factor that is largely unaccounted for in traditional theoretical models of technology adoption.

Summary

The present research has implications for additional research into rural information use environments, information systems design, and technology diffusion theory. Specific suggestions include:

- Investigating rural populations that, like cattle breeders, have very similar information needs and are geographically dispersed to compare rates of computer technology adoption based on their information use environment.

- Assessing the effect the Internet has on trading patterns for widely dispersed rural populations.

- Using an alternative design model for system conceptualization in which designers seek first to understand users' business problems and information use environments as a precursor to specifying user requirements.

- Investigating adopters of networked information services whom later abandon or reduce their use of the Web in favor of more traditional media. This could be accomplished by using the statistical method of survival analysis and could be used to propose extending traditional models of technology diffusion past the adoption phase for complex innovations.

APPENDIX A

INTERVIEW WITH THE RED ANGUS ASSOCIATION OF AMERICA

APPENDIX A

Interview with the information service provider, The Red Angus Association of America.

Meeting Notes:

Dr. Dick Gilbert, Executive Secretary, and Lynn Gordon, Communications Coordinator of the Red Angus Association, Dr. Amanda Spink and Jane Hicks of the University of North Texas met in Denton, Texas to discuss the information needs of cattle breeders and the creation of a web-based system provisionally titled Red Angus Online. The goal of the discussion was to reach a shared understanding of breeders' information environment and the nature of the proposed Web-based information system.

1. What is the general outlook for the cattle breeding business?

The general outlook for the cattle industry is good. This year the percentage of meals eaten outside the home in the United States is 51%, over 50% for the first time. Demand is very strong. There is a 20%-30% shortfall in domestic meat supplied to the American market; 70% of the average grade of USDA choice is exported. Japan has been the target export market for prime beef for the last ten years. Demand there is strong in general, and in particular, Red and Black Angus breeds produce the best carcasses for the high-end market. The demand is expected to expand to lower grades of beef as Japanese average consumer income grows and opportunities to invest in land or housing become even fewer.

Access to U.S. genetics is now a big market, but artificial insemination (AI) is not a big component. For the past 20 years, only 3%-5% of beef cattle have been produced with AI. Also, some diseases can be transmitted even with the best technology for freezing and packaging semen, and international trade restrictions vary.

2. What are the ranchers' business problems and opportunities? What kinds of information might they find useful?

Animal ranching is traditionally conceived as physical health, reproductive health, general nutrition, meats, and management. Breeding concentrates on reproductive health, but all the related information categories apply as well to specialized stud farms. Ranchers also have the tradtional problems of inheritance, of keeping their children interested in the business they have built. They may have conservation and land use issues or problems complying with government regulations. Marketing and market conditions are ongoing problem areas.

3. Which problems does the RAAA address with its current information services?

Primarily, the problems of collecting, processing, and publishing cattle registration information, including reproductive marketing information in the form of a sire directory. The RAAA publishes a monthly magazine, American Red Angus, that provides an index to breeders and covers a range of topics. The staff provides consultation and recommendations on breeding and general business problems. The RAAA provides livestock auctions and a marketing network that links producers to potential buyers of their calves and feeder cattle.

4. Who is the core market for the information the RAAA provides, and what is the general outlook for their use of information technology?

The core users of RAAA information services are the 1600 members, as distinguished from the buyers and suppliers who use RAAA information products, also an important market. The most important information service provided by the Association to this core group is the sire directory.

More members are expected to connect to the WWW as telephone companies gear up to provide local access to the Internet. A network presence is expected to remain a lucrative market for local telephone providers. Network connections will probably happen faster than the spread of telephone party lines. Also, members who now use stand-alone ranch management software packages are expected to increasingly adopt network technology. (This group includes the 200 members to whom the RAAA sends RRTS disks of registration statistics collection and reporting.)

5. What further information services does the Association plan to offer?

Members currently refer to printed or disk copies of cattle directories, or call the marketing staff of the RAAA for breed registration information. This information needs to be supported online, for convenience, efficiency, and timeliness, with sire directory information, supported with search capability maintained by the Red Angus, with access through Internet Global (IG) in Lewisville, Texas. Sire summary look-up queries to IG's site will be managed with Sire Finder, an RAAA search program mounted on the IG server; the search request will then be routed to the RAAA computer site, the database consulted, and a response sent back to the IG.

6. What types of networked information are now available to members via the Web? From which sources? Which of these provide the most useful links for members?

(This group of questions was considered only in general terms during the interview, based on previous exchanges of Web site examples from other ranching associations,

individual ranchers, university digital libraries, ad well as commercial, educational, and government sites).

7. What is the scope of your proposed Web site? In there a development plan and a transition plan?

The primary use the RAAA is making of their network connection at present is for file transfer to and from Colorado State University, where sire evaluation data is processed. The RAAA also uses the network to contact suppliers and use e-mail.

The purpose of the Web site is conceived primarily as a service to members, in their pursuit of business goals related to cattle breeding. The transition plan is conceived of as presenting first a primarily RAAA-to-member network, to grow to member-to-member and member-to-the-world network. The first core service will be an online searchable sire directory. Other content of the Web site should also include much of the text of American Red Angus, advertising space (want ads and for-sale ads), trading bulletin board, along with general information about Red Angus, such as: strengths of the breed, history of the breed, board of directors of the RAAA, directories to regional and state associations, and contacts with the U.S. agricultural extension service.

The RAAA's time frame for deployment includes getting a Web page up by the end of January, 1997. The RAAA is deciding whether to charge a fee to provide a link from the RAAA site to member pages. Plans also call for providing online auctions of embryos and semen.

One goal of the RAAA is to increase members' knowledge of the cattle-breeding business, and so the Association plans to provide directories of "how-to" resources on the Web. These educational links will be only for business-related, not general, kinds of information and should probably be limited to selected sources.

Another goal is to provide a vehicle for linking members to other members. Referring members to newsgroups, listservs, or chat lines was suggested by Dr. Spink. This will be reconsidered later, but for now is considered to carry too much risk of overwhelming unprepared users with the volume of messages exchanged on many such discussion networks. The RAAA will provide an online directory of members and their e-mail addresses as a beginning to acting as a provider and catalyst for member-to-member connections. Eventual services will include multimedia applications.

The meeting then concluded with a discussion of the surveys to be conducted as part of the present research.

APPENDIX B

FIRST SURVEY QUESTIONNAIRE

Red Angus Association of America

4201 I-35 North. Denton. Texas 76207-3415
(817) 387-3502 • FAX (817) 383-4036

August 24, 1995

Dear Member:

As part of our mission to serve you better, we need to know about your interests and priorities for electronic services. To help us understand your need for such services, we ask that you complete the following survey about the use of computer networks on your ranch.

Your response is very important, whether you currently use computer network services or not. We also know that your time is valuable, so we have kept the survey as brief as possible.

Each member's responses to this survey will be kept confidential. Two researchers from the University of North Texas, Dr. Amanda Spink and Jane Hicks will be assisting us with analyzing overall results, which we will be happy to share with you as soon as they are available.

Please return your completed survey to us by the end of September. For your convenience, you will find a stamped, addressed envelope attached.

Thank you very much for contributing your thoughts to this effort.

Sincerely,

Richard P. Gilbert, Ph.D.
Executive Secretary

THE ELECTRONIC RANCH:
SURVEY OF COMPUTER NETWORK SERVICES USED BY CATTLE RANCHERS

For our purposes here, computer networks are defined as telecommunications links between computers. Examples of services include the commercial network providers such as America Online and CompuServe, the Internet, databases of information around the world, electronic bulletin boards and electronic mail services.

1. Do you use any of the following equipment?
   (Please check *all* that you use).

   ___ fax machine
   ___ modem
   ___ IBM compatible computer
   ___ CD-ROM drive
   ___ Macintosh computer
   ___ laptop/hand held computer
   ___ satellite dish
   ___ other _____

2 Do you ever use any kind of computer network services on your ranch?

   _____ No, I never use computer network services. Please go to question 3.
   _____ Yes, I personally use computer network services. If yes, please answer 2a, 2b, and 2c.

   2a. About what percent of your typical work week is spent using computer network services? _____ %

   2b. How long have you been using a computer network services?
       _____ years   _____ months

   2c. Why did you start using computer network services?

3. Do you or other members of your family use computer networks outside the home?

   _____ No. Please go to question 4.
   _____ Yes. If yes, please check all that apply.
   At least one member of my family, staff, or I use computer networks at:
   3a. _____ school/college
   3b. _____ a work location away from the ranch
   3c. _____ library
   3d. _____ other _____

4. **TYPES OF INFORMATION NEEDED BY CATTLE RANCHERS**

Please indicate the value of each type of information you need.

Type of Information	What is its value to you?				Do you use a computer network to find this type of information?		
	High 1	2	3	Low 4	Yes	No	If no, would you like to?
Breeding information							
Auction values							
General market information							
Veterinary information							
Agricultural chemicals							
Pest management							
Water resources							
Environment regulations							
Weather							
Government regulations							
Community information							
Education							
Travel							
Family health							
Other (please list)							

5. INFORMATION SOURCES USED BY CATTLE RANCHERS

Please indicate the value of each business information source you use.

Business Information Sources	What is their value to you?				Do you use a computer network to contact these sources?		
	High 1	2	3	Low 4	Yes	No	If no, would you like to?
Customers							
Suppliers/Vendors							
Other Ranchers							
Ranching Associations							
Extension Agents							
County/State Health Dept							
Other Govt. Agencies							
Libraries							
Newspapers							
Industry Magazines							
Bulletin Boards							
Political alliance groups							
Other (please list)							

6. VALUE AND USE OF COMPUTER NETWORK SERVICES

Please indicate if you have used any of the following network services.
If you have used a service, rate its value to you.

TYPE OF NETWORK SERVICE	HAVE YOU USED THIS SERVICE?			IF YES, PLEASE RATE THE VALUE OF THIS SERVICE			
	Yes	No	Don't know	High 1	2	3	Low 4
Red Angus Bulletin Board							
Red Angus Sire Finder							
AGNET (Agriculture Computer Network)							
AGRIBUSINESS U.S.A.							
AGRICOLA (National Agriculture Library)							
AgriData Network							
AG*SAT (Agricultural Satellite Corporation)							
Commercial networks:							
• America On Line							
• CompuServe							
• Prodigy							
• The Source							
Internet							
Online library Catalogs							
USDA Online							
Other (please list)							

7. What do you think are the three biggest barriers to using network services?

8. What are the three most important factors that encouraged your use of network services, or that could encourage your use?

9. Overall, how would you describe your reaction to computer network services? (Please circle the number of the most suitable response).

    1   They could revolutionalize ranching.
    2   They are useful in many respects.
    3   I am neutral or indifferent to them.
    5   They are not useful in many respects.
    6   They are worthless and should not be implemented.

10. Will you please tell us the size of your herd?　　1-50　　＿＿＿＿
                                                      50-100　　＿＿＿＿
                                                      100-300　＿＿＿＿
                                                      over 300　＿＿＿＿

10. Are you interested in participating in follow-up research related to this survey, such as a telephone call or site visit regarding your network use and information needs? If so, please provide your name, address and contact information.

_____

_____

_____

MANY THANKS!

APPENDIX C

THE ELECTRONIC RANCH:

COMPUTER NETWORK SERVICES USED BY RED ANGUS BREEDERS

AMERICAN RED ANGUS,

AUGUST 1996

The Electronic Ranch: Computer Network Services Used by Red Angus Breeders

Changes are occurring within the technology industry almost as fast as you can send your e-mail message. These changes are taking the level of communication one step further and now we commonly discuss e-mail, world wide web pages, Internet sites and computer networks. With these ever increasing changes in the ways we can access information we must also take some time to measure our current status with computer usage and technology.

Therefore in the fall of 1995, 230 Red Angus breeders responded to a survey conducted in conjunction with the Red Angus Association of American (RAAA) and with researchers Dr. Amanda Spink and Jane Hicks from the University of North Texas. Participants were from twenty states plus one response from Canada. Researchers from the University of North Texas, conducted the survey for the Red Angus Association. The purpose of the study was to determine the interests and priorities for electronic services among the Red Angus Association membership.

Computer equipment used by Red Angus members:
- 126 IBM compatible computers
- 1 Macintosh computer
- 77 fax machines
- 58 CD-ROM drives
- 57 modems
- 56 satellite dishes

Responses were gathered via a survey and the focus was on electronic services such as COMPUTER NETWORKS. COMPUTER NETWORKS were defined in this study as telecommunication links between computers. Examples are Amercia Online, Compu Serve, Internet and Electronic bulletin boards and mail services.

Many of the respondents utilized modems or satellite dishes to expand accessing capabilities of their computer. Computer network services have been used on 27 ranches for an average of just under two years. About 5% of work time is spent using computer networks, for reasons that include getting up-to-date market information, fast access to a wide range of information services, breeding information exchange with cattle associations for education and "keeping up".

Currently, computer networks are used most often to gain information about the weather and for educational information.

Sources of information valued by the breeders came from other ranchers, customers, industry magazines and suppliers.

Respondents ranked the value of computer network services they were currently using.

What network services are used by Red Angus members?

(Listed in order of importance)	(Number of users)	(Listed in order of importance)	(Number of users)
Red Angus Sire Finder	27	AGNET	6
Internet	24	AGRICOLA	3
Red Angus Bulletin Board	14	AgriData Network	3
America Online	22	Other (various)	4
CompuServe	15	AGRIBUSINESS U.S.A.	3
Online library catalogs	10	USDA Online	3
Prodigy	11	The Source	1
AG*SAT	8		

Your interest level may be very high in owning a computer and connecting to computer network systems, but having your system up and running may not be that easy. Barriers most commonly mentioned by the survey respondents that limited or prevented their participation in network services were cost of equipment and telephone access charges. The time and effort required to learn how to use the computer was frequently cited as a barrier, especially the lack of access to know-how or training, or, as one rancher summed it up, "there is no easy way to get started". The time to find good information once you're up and running was cited as a drawback by several who now use computer networks and security or privacy concerns were also limitations.

On the other hand, the quality and quantity of information available and the speed and convenience of using online services were the factors that encourage the use of computer network service by Red Angus members. Several members said that local telephone access (no long-distance charges) was the main factor that could encourage their use of computer networks.

What do Red Angus members think about computer network services?

	Number of responses
They are useful in many respects	82
They are neutral or indifferent	35
They could revolutionize ranching	20
They are not useful in many respects	7
They are worthless	2
Missing responses	84

APPENDIX D

SECOND SURVEY QUESTIONNAIRE

RED ANGUS
ASSOCIATION OF AMERICA

4201 N. Interstate 35 • Denton, TX 76207-3415 • (940) 387-3502 • FAX (940) 383-4036

Thank you again for responding to the first Electronic Ranch survey in 1995/1996. Enclosed you will find the second Electronic Ranch survey. As in the first survey, two researchers from the University of North Texas, Dr. Amanda Spink and Jane Hicks, will collect the data and help us analyze the overall results. If you have any questions about the survey, you may E-mail Jane at gjh0001@jove.acs.unt.edu or call her at 940-891-0992.

> If you do not use the Internet or the Web, please check here _____
> and return in the post paid envelope provided.

If you do currently use the Internet or the Web, please complete the remainder of this follow up survey. Either way, your response is very important and will help us plan how to serve you better.

Results may be published in the *American Red Angus*, as they were for the first survey, but your individual response remains confidential. Your prompt response is deeply appreciated.

Thank you.

Very truly yours,

Dr. R. L. "Bob" Hough
Executive Secretary

1. Types & Sources of Information

Which of the following types of information have you used or do you currently use via network services?	What is the overall impact on your business operations of having networked access to this type of information?					
	Very Positive	Positive	Neutral	Negative	Very Negative	Not Available
Breeding information						
Auction values						
General market information						
Product information for ranch supplies/equipment						
Veterinary information						
Agricultural chemicals						
Pest management						
Water resources						
Government regulations						
Weather						
Environment/conservation						
Estate planning						
Taxes						

Which of the following sources of information have you used or do you currently use via network services?	What is the overall impact on your business operations of having networked access to this source of information?					
	Very Positive	Positive	Neutral	Negative	Very Negative	Not Available
Customers						
Suppliers/vendors						
Other ranchers						
Ranching associations						
Extension agents						
County/state health dept.						
Other government agencies						
Libraries						
Newspapers						
Industry magazines						
Bulletin boards						

2. Use of Networked Services

For all of the services that you currently use. please rank the importance of the following network services (1 is the most important, 8 is the least important):

_____ Email

_____ World Wide Web

_____ File transfer (FTP)

_____ Telnet

_____ Gopher

_____ Newsgroups/Usenet

_____ Chat/online discussion

_____ Other (please identify) _____

_____

_____

What do you find are the biggest problems using the Web? (Please check all that apply)

_____ Not being able to find the information I am looking for

_____ Not being able to efficiently organize the information I gather

_____ Not being able to find a page or Website I know is out there

_____ Not being able to return to a page I once visited

_____ Not being able to determine where I am

_____ Not being able to visualize where I have been and where I can go

_____ It takes too long to view/download pages

_____ It costs too much

_____ Encountering links that do not work

_____ Other (please explain) _____

_____

_____

Which of the following Web sites do you use? (Please check all that apply)

_____ The Red Angus Association   (http://www.redangus1.org)

_____ Other cattle associations. such as   (http://www.angus.org)

_____ The Livestock Virtual Library   (http://www.ansi.okstate.edu/library/)

_____ Chicago Mercantile Exchange   (http://www.cme.com/exchange/)

_____ Beef Home Page   (http://www.beef.org)

_____ Cowman's Choice cattle marketing   (http://www.cowmans.com)

_____ Industry journal abstracts   (http://www.agribusiness.com)

_____ Beef Today   (http://www.farmjournal.com/beeftoday/)

_____ Livestockplus Online   (http://home.rica.net/livestockplus/)

_____ National Agricultural Library   (http://www.agricola.gov)

_____ Other (please identify)

_____

_____

3. General Survey Questions

A.   Since the time of the first survey, have you:
        _____ Upgraded your computer equipment?
        _____ Created a Web site for your ranch?
        _____ Considered the advantages of using the Web to advertise?

B.   About what percentage of your typical work week is spent using
       computer network services? _____%

C.   What are the greatest advantages to your business of using networked services?

D.   What are the greatest disadvantages to your business of using networked services?

E.   Please offer any comments/suggestions regarding anything not asked on this survey:

Many thanks!

APPENDIX E

VERBATIM RESPONSES TO SURVEY QUESTIONS

APPENDIX E

Responses to open-ended questions from the first survey regarding barriers to computer network adoption and factors that encourage network adoption are shown in this appendix. Also shown are responses to questions from the second survey regarding disadvantages and advantages to network use.

Verbatim responses to the first survey

Shown following are respondents' verbatim replies to question 7 from the first survey: "What do your think are the three biggest barriers to adopting networked services?" Respondent code numbers are shown to the far left.

027   Learning how and when to use it and finding the time

046   No response

058   Availability. Cost. Knowledge to operate.

074   Not enough trained personnel. Not enough trained personnel. Not enough trained personnel.

083   No response

118   Cost. Lack of computer skills. Time.

119   Inability to understand computers. Time. Lack of equipment.

128   I have not yet use my mode. I am learning to use the computer and soon will be using the modem.

135   Time. Cost of some areas.

144   I need to purchase a new computer or up-date old one. As soon as I can afford a new computer I will subscribe to an online service.

161   Computer education. Phone costs. Time commitment.

185   Cost. User friendly. Results? Time.

187   Lack of computer expertise

191   Lack of knowledge in computer usage. Lack of computer hardware.

208   Because of our location. We have an old communications system (RT Communications) with a min-max 2400-baud. We cannot access some systems.

Shown following are verbatim replies to question 8 from the first survey: "What are the three most important factors that encouraged your use of network services, or that could encourage your use?" Respondent code numbers are shown to the far left.

027   Quality of information

046   Availability of information out there. Online availability of having data instantly. Marketing possibilities.

058   Selling opportunities. Gain of information (types of info available). Ease of operating system

074   It works each time I call in. Get a response from my downloads. Put something on the bulletin board

083   Access to information. Ease of use (your own time 24 hours a day). I enjoy computers.

118   No response

119   Speed of information.

128   No response to this question on the first survey.

135   Access to info. Speed of transferring data.

144   No response

161   Speed, turnaround time. Up to date info

185   Results. User friendly. Cost. Time.

187   The value of info that is available on the WWW

191   Rapid availability of services. Increased availability of services.

208   Info access

Verbatim responses to the second survey

Respondents' verbatim replies to the second survey question: "What are the greatest disadvantages to your business of using networked services?" are shown below. Respondent code numbers are shown to the far left.

027   Cost of advertising and upkeep

046   Not being able to connect to a site when you really need to.

058   The mass confusion of the net.

074   No response

083   Customers finding my site.

118   Need more network participants.

119   Time consuming.

128   Another job to do.

135   The information super highway is more like a gravel road. Sometimes the time needed to download necessary pages is needed elsewhere.

144   Wasting time or not getting to bed on time.

161   Too much time needed to learn how to use effectively.

185   Haven't had any luck selling.

187   No response

191   Lack of numbers of people on the net. Slowness in establishing web sites (on my part as well).

208   Not getting on line.

Respondents' replies to the open-ended question regarding disadvantages to their businesses of using networked information services can be summarized as follows

Opportunity costs of time	4
Confusion of the Net	2
Not enough participants	2
Low return on marketing efforts	2
Upkeep	2
Not getting online	1

Respondents' verbatim replies to the open-ended question: "What are the greatest advantages to your business of using networked services?" are shown below. Respondent code numbers are shown to the far left.

027	Up to date market info and breed information
046	Being able to send mail faster, have a wide array of information at your fingertips.
058	Emailing to customers/clients and suppliers.
074	Speed. No mailing cost.
083	More customer contact.
118	Quick access to RAAA information, THR (*Total Herd Reporting*), and Red Angus Sire Summary.
119	Timely information
128	Information retrieval. Information exchange. Advertising. Communication.
135	File transfer, access to information and Email to foreign countries.
144	Email. I work outside most of the day and can come in at night and email someone about something I forgot during the day.
161	To get information and email.
185	Time/cost savings.
187	Following investments and email.
191	Communication with other ranchers. Communication with national organization.
208	Fast info

Respondents' replies to the open-ended question regarding advantages to their businesses of using networked information services can be summarized as follows

Email (nonspecific)	7
Specific communication with	5
Customers (2)	
Foreign countries	
Other ranchers	
Ranch associations	
Access to information	5
Timely information	4
Time/cost savings	2

REFERENCES

Aguilar, F. J. (1967). Scanning the business environment. New York, NY: MacMillan Co.

Ajzen, I., & Fishbein, M. (1980). Understanding attitudes and predicting social behavior. Englewood Cliffs, NJ: Prentice-Hall.

Avalos, M. & De Young, T. (1995, Winter). Preferences of water policy in the Ogallala region of New Mexico: Distributive vs. regulatory solutions. Policy Studies Journal, 23, 668-686.

Belkin, N. J. (1980). Anomalous states of knowledge as a basis for information retrieval. The Canadian Journal of Information Science, 5, 133-143.

Belkin, N. J., Oddy, R., & Brooks, H. (1982). ASK for information retrieval: I. Background and theory. Journal of Documentation, 38, 61-71.

Bettman, J. R. (1979). An information processing theory of consumer choice. Reading, MA: Addison-Wesley.

Bishop, A. P. (1994, March). The role of computer networks in aerospace engineering. Library Trends, 42(4), 694-729.

Braden, W. F. (1981). Small farm operators in Texas: Their information needs and sources. Dissertation Abstracts International 42(03), 903.

165

Choo, C.W., & Auster, E. (1993). Environmental scanning: Acquisition and use of information by managers. In: Martha E. Williams (Ed.) Annual Review of Information Science and Technology, 28, Medford, NJ: Learned Information, 279-309. State of the Net : The New Frontier

Clemente, P. (1998). State of the net: The new frontier. New York, NY: McGraw-Hill.

Daniels, T., & Bowers, D. (1997). Holding our ground: Protecting America's farms and farmland. Washington, DC: Island Press.

Davis, F. D. (1989). User acceptance of information technology: Systems characteristics, user perceptions, and behavioral impacts. International Journal of Man-Machine Studies, 38(3), 475-487.

Davis, G. B., & Olson, M. H. (1985). Management information systems: Conceptual foundations, structure, and development (2nd ed.). New York: McGraw-Hill.

Dervin, B. (1976). The everyday information needs of the average citizen: A taxonomy for analysis. In M. Kochen & J. C. Donohue (Eds.), Information for the community. Chicago, IL: American Library Association.

Dervin, B. (1983). An overview of sense-making research: Concepts, methods, and results to date. Paper presented at: International Communication Association Annual Meeting: 1983, May 26-29, Dallas, TX. Available from the author, Department of Communication, Ohio State University, Columbus, Ohio, 43210.

Dervin, B., & Nilan, M. (1986). Information needs and uses. In: M. E. Williams (Ed.), Annual review of information science and technology, Vol. 21. 1-25.

Dervin, B. & Voight, M. J. (Eds.). (1991). Progress in communication sciences. Norwood, NJ: Ablex.

Dillman, D. A. (1984). The social impacts of information technologies in rural North America. Proceedings of the Rural Sociological Society 47th Annual Meeting. College Station, TX: Texas A&M University.

Doorman, F. (1991). Framework for the rapid appraisal of factors that influence the adoption and impact of new agricultural technology. Human Organization: Journal of the Society for Applied Anthropology, 50(3), 235-244.

Drucker, P. F. (1973). Management: Tasks, responsibilities, practices. New York, NY: Harper & Row, Publishers.

Drucker, P. F. (1989). The new realities: In government and politics/ in economics and business/ in society and world view. New York, NY: Harper & Row, Publishers.

Drucker, P. F. (1995). The information executives truly need. Harvard Business Review. 73(1), 54-62.

Duvall, L. M. (1993). A study of problematic situations and information needs of software managers in the United States and Japan, Doctoral dissertation, Syracuse University. 253 pages.

FIND/SVP, Emerging Technologies Research Group, Cyber Dialogue Inc (1996, 1997, 1998). http://etrg.findsvp.com/

Fliegal, F. C. (1993). Diffusion research in rural sociology: the record and prospects for the future. Westport, CT.: Greenwood Press.

Frank, R. C. (1987). Agricultural information systems and services.

In: M. E. Williams (Ed.). Annual Review Of Information Science and Technology, Vol. 22. 293-334

Georgia Tech, Graphic, Visualization, & Useabilty Center (GVU) of the Georgia Institute of Technology (1995, 1996, 1997, 1998). http://www.gvu.gatech.edu/user/surveys/

Giddens, A. (1979). Central problems in social theory: action, structure, and construction in social analysis. Berkeley, CA: University of California Press.

Goldman, A. I. (1992). A theory of human action. Bradford, CN: Bradford Books.

Gorry, G. A. & Morton, M. S. (Fall 1971; republished Spring 1989). A framework for management information systems, Sloan Management Review.

Hadwiger, D. F. (1992). Technology in a fragmented politics: The case of agricultural research. Technology in Society, 14(3), 283-298.

Hewins, E. T. (1990). Information need and use studies. In: M. E. Williams (Ed.), Annual review of information science and technology, Vol.25. (pp.145-172).

Hill, H. K. (1987). Methods of analysis of information needs. Unpublished master's thesis, Texas Woman's University, Denton, TX.

Hiltz, S. R. (1988). Productivity enhacement from computer-mediated communication: A system contingency approach. Communications of the ACM, 31(12), 1438-1454.

Hiltz, S. R., & Johnson, K. (1989). Measuring acceptance of computer-mediated communication system. Journal of the American Society for Information Science, 40(6), 386-397.

Hiltz, S. R., & Turoff, M. (1993). The network nation: Human communication via computer. Cambridge, MA: MIT.

Hoglund, L. & Persson, O. (1982). Research on the needs and uses of scientific and technical information: Research areas and problems. In I. Friberg (Ed.), The fourth international research forun in information science: Proceedings. (pp.185-205). Boras, Switzerland: Skrifter fan Hogskolan i Boras.

Jain, S. C. (1984). Environmental scanning in U. S. corporations. Long-Range Planning, 17(2), 117-128.

Jover, P. L. (1991). Beef cattle management practices and participation in the maximum immunity minimum stress program in Oktibbeha County, Mississippi. Masters Abstracts International, 29(04), 529.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decsion under risk. Econometrica, 47, 263-292.

Katzer, J., & Fletcher, P. (1992). The information environment of managers. New York, NY: Harper & Row, Publishers.

Kochen, M. (1983). Information and society. In: M. E. Williams (Ed.), Annual review of information science and technology, Vol.25. (pp. 277-304). Elsevier Science Publishers

Kotter, J. P. (1982a). The general managers. New York, NY: The Free Press.

Kotter, J. P. (1982b, November-December) What effective general managers really do. Harvard Business Review, 60, 156-167.

Kunz, W., Rittel, H.W.J. & Schwuchow, W. (1977). Methods of analysis and evaluation of information needs: A critical review. Munich: Verlag Dokumentation.

LaCaille, J. P. (Ed.). (1995, June). The rural information center assists local communities. Library Trends, 44(1), 152-175.

LaRose, R., & Mettler, J. (1989). Who uses information technologies in rural America. Journal of Communication, 39(3), 48-59.

Lavin, M. R. (1992). Business information: How to find it, how to use it. Phoenix, AZ: Oryx Press.

Longwell, J. H. (1955, April). Information seeking habits and characteristics of farm operators (Research Bulletin). ((581)). Columbia, MO: College of Agriculture-Unversity of Missouri. HT 421 L56 1955.

Lundeen, G.W., Tenopir, C., & Wermanger, P. (1994, April). Information needs of rural health care practitioners in Hawaii. Bulletin of the Medical Library Association, 82(2), 197-205.

MacMullin, S.E., & Taylor, R.S. (1984). Problem dimensions and information traits. The Information Society, 3, 91-111.

Martin, J. (1985). Fourth-generation languages. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Mathews, E. (1986). Agriculture. In B. Katz & L. S. Katz (Eds.), Magazines for Libraries. New York, NY: R. R. Bowker Company.

McGary Meij, E. G., & Abdalla, C.W. (March/April 1990). A comprehensive approach to groundwater management for rural local governments. Journal of Soil and Water Conservation, 45, 226-229.

McGuinn D., & Raymond J. (Winter 1997-1998). Workers of the world, get online. Newsweek, 32-33.

Mintzberg, H. (1973). The nature of managerial work. New York, NY: Harper & Row, Publishers.

Mintzberg, H. (1994). The rise and fall of strategic planning. Harvard Business Review, 72(1), 107-114.

Newell, A., & Simon, H. A. (1972). Human problem solving. Englewood Cliffs, NJ: Prentice Hall.

Osborn, T., & Heimlich, R. (1994, July). Changes ahead for the conservation reserve program. Agricultural Outlook, 26-30.

Payne, J. W., Bettman, J. R., & Johnson, E. J. (1992). Behavioral decision research: A constructive process perspective. Annual Review of Psychology, 43, 87-131.

Payne, J. W., Bettman, J. R., & Johnson, E. J. (1997). The adaptive decision maker: Effort and accuracy in choice. In W. M. Goldstein & R. M. Hogarth (Eds.), Research on judgment and decision making. Cambridge, UK: Cambridge University Press.

Paisley, W. J. (1968). Information needs and uses. Annual Review of Information Science and Technology, 3, 1-30.

Rice, R. E., & Paisley, W. (1982, September). The Green Thumb videotex experiment. Telecommunications Policy, 82(1), 223-235.

Risdon P., & Ostergard, M. (1995). 4-H on the Internet. Journal of Extension, 33(1), 32-38.

Rogers, E. M. (1995). Diffusion of innovations (4th ed.). New York: Free Press.

Rosenbaum, H. (1996). Structure and action: Towards a new concept of the information use environment. In: S. Hardin, (Ed.). Proceedings of the 59th Annual Meeting of the American Society for Information Science, 152-156.

Russo, N. L. (1994, February). The impact of context on innovation in information systems. Unpublished doctoral dissertation, Georgia State University, xxx

Seidel, Jr., G. E. (1989, April). Geneticists in the pasture: Improving methods for breeding farm animals. Technology Review, 92, 42-53.

Shafir, E., Simonson, I., & Tversky, A. (1997). Reason-based choice. In W. M. Goldstein & R. M. Hogarth (Eds.), Research on judgment and decision making (pp. 181-204). Cambridge, UK: Cambridge University Press.

Simon, H. A. (1955). A behavioral model of rational choice. Quarterly Journal of Econmics, 69, 99-118.

Simon, H. A. (1977). The new science of management decision.

Simon, H. A. (1981). The sciences of the artificial. (2nd ed.). Cambridge, MA:

Sumner, D.A. (1995). Agricultural policy reform in the United States. Washington, DC: The American Enterprise Institute Press.

Spink, A., & Hicks, J. (1997). Development of the digital ranch. <u>D-Lib Magazine</u>, http://www.dlib.org/dlib/november97/11spink.html

Spink, A., & Hicks, J. (1996). A study of the development of the digital ranch. <u>Information Research, 2,</u> (3), 133-136.

Targowski, A. (1990). <u>The architecture and planning of enterprise-wide information management systems.</u> Harrisburg, PA: Idea Group Publishing.

Taylor, R. S. (1968). Question negotiation and information seeking in libraries. <u>College and Research Libraries, 29,</u> (3), 178-194.

Taylor, R. S. (1986a). <u>Value-added processes in information systems.</u> Norwood, NJ: Ablex.

Taylor, R. S. (1986b). On the study of information use environments. In: J. Hurd & C. Davis, (Eds.). <u>Proceedings of the 49th Annual Meeting of the American Society for Information Science,</u> 331-334.

Taylor, R. S. (1991). Information use environments. <u>Progress in Communication Sciences, 10,</u> 217-255.

Thurman, W. N. (1995). Farm programs and the environment. In D. A. Sumner (Ed.), <u>Agricultural policy reform in the United States</u> (pp. 156-184). Washington, DC: The American Enterprise Institute Press.

Tweeten, L. (1983, March 4). The economics of small farms. <u>Science, 219,</u> 1037-1043.

Tversky, A. (1969). Instransitivity of preferences. Psychological Review, 76, 31-48.

Tversky, A., & Simonson, I. (1993). Context-dependent preferences. Management Science, 39, 1179-1189.

U.S. Department of Agriculture; National Commission on Libraries and Information Science, 1982 Joint Congressional Hearings on the Changing Information Needs of Rural America: The Role of Libraries and Information Technology. Washington, DC: U.S. Government Printing Office.

Ullman, D.A., Williams, S., & Emal, J. (1996). Using technology to stimulate rural economic development activity: Nebraska's community Internet navigator program. Economic Development Review, 14, (1), 14-15.

Ulrich, H. (1989). Losing ground: Agricultural policy and the decline of the American farm. Chicago, IL: Chicago Review Press.

von Newmann, J., & Mortgenstern, O. (1947). Theory of games and economic behavior. Princeton, NJ: Princeton University Press.

Wersig, G., & Windel, G. (1985). Information science needs a theory of `information actions'. Social Science Information Studies, 5, 11-23.

Williams, M. E., & Robins, C. G., Eds. (1985). Agricultural databases directory. Washington, DC: U. S. Department of Agriculture, National Agricultural Library.

Wright, B. D. (1995). Goals and reality for farm policy. In D. A. Sumner (Ed.), Agricultural policy reform in the United States (pp. 9-44). Washington, DC: The American Enterprise Institute Press.

Yeutter, C. (1995, August 15). The New International Trade Environment for Agriculture. Vital Speeches of the Day, LXI(21), 648-650. Delivered at World Congress V, International Agribusiness Management Association, Paris, France, May 16, 1995.

Zijp, W. (1994). Improving the use and transfer of agricultural information: A guide to information technology. World Bank Discussion Papers, 247.