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ENHANCING MANAGEMENT DECISIONS - HISTORY OF THE DECISION EVALUATOR FOR THE CATTLE INDUSTRY

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Introduction

Ranch management is the decision making process of resource allocation for a business enterprise that manages natural resources, animals and capitol to meet goals of profitability and sustainability. While this brief sentence captures the essence of ranch management, simplicity is hardly one of ranch decision-making's characteristics. The diagram in Figure 1 has been used to describe the challenge of ranch management as a web of information and complex inter-relationships that influence the viability of a beef cattle enterprise. While even this diagram simplifies the complexities faced by ranchers as they grapple with decisions, it does add sensitivity and understanding.

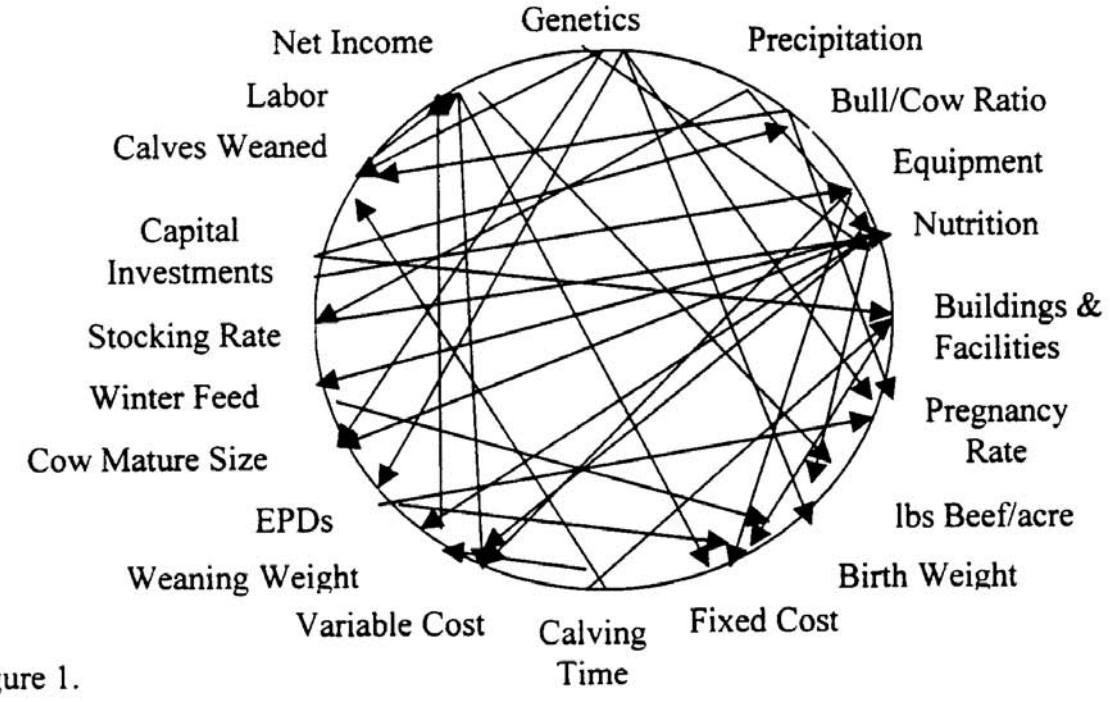

Figure 1.

Changing the Decision-Making Process

Management, especially ranch management, is often described as an art. The artistic or qualitative, aspects of ranch decision making are extremely important. These are often referred to with comments like, "he has a feel for the market" or "she really knows her cows" or "they made their luck". These qualitative parts of ranch decision making are of no less importance today in the age of information than they were ninety-nine years ago at the turn of the last century of the millennium.

However, the high levels of investment in cattle ranching today, along with increased risk and the volatility of livestock and grain markets has forever changed the decision making process for cattlemen. On an economic basis, 125 herds from the Northern Great Plains have an average investment of $2853 per cow (Hamilton, 1999). The corresponding cost of producing calves in this region is also high. The average economic cost per CWT of weaned calf for a sample of ranches in southwestern Colorado was $126.00 (Lankister, et al., 1996). This past fall, corn in eastern South Dakota was worth approximately 25% of what it was in the summer of 1996. In South Dakota, the value of a 500 pound weaned calf has risen 30% over the last 36 months. For individual operations to be viable, the decision-making process for cattlemen in the 2lst century will have to look much more like the model in Figure 2 (Anderson, 1997), than the seat of the saddle approach of one-hundred years ago.

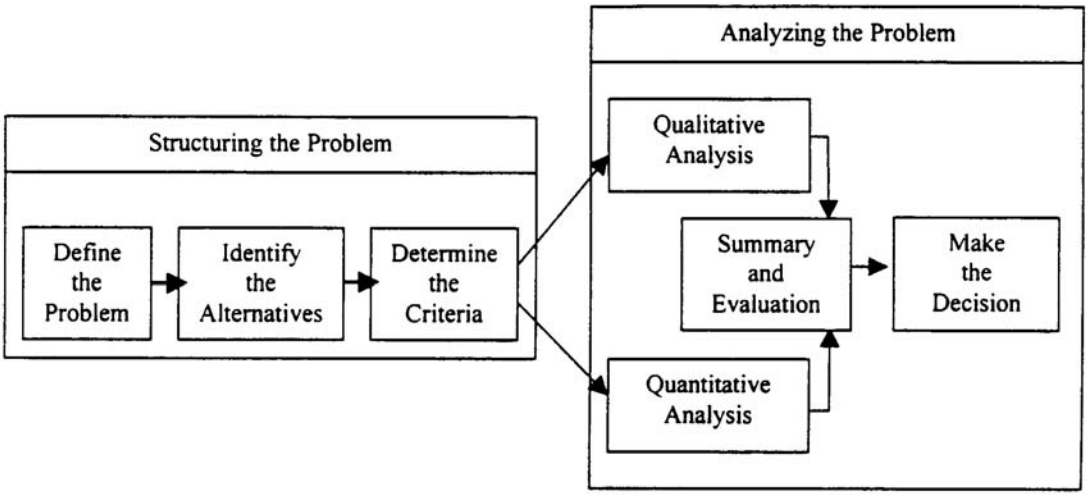

Figure 2.

As we walk into the next century, every step of the decision-making process will be fundamentally different. Step 1, Defining the Problem, would seem to be basically the same, but living in the days of information overload makes even defining a problem difficult. For example, Is a drop in pregnancy rate due to genetics, nutrition, a herd health problem or a wet spring? Or was it due to some combination of factors? Or is it a problem at all? The same can be said for Step 2, Identifying Alternatives. If the drop in pregnancy is due to nutrition, could the problem

be solved by increasing supplemental feed? Would it be less expensive to decrease stocking rate or change the time of calving? Is there extra pasture available to rent? What is the price of hay? All of these are viable alternatives. The third step, Determining the Criteria, involves defining the standards on which the decision will be made. Here again, the information age has changed the process. The rapid diffusion of the need for, and the principals of; Beef Quality Assurance is a dramatic example of how the fundamentals of our industry have changed. Cattlemen are aware and do care about food safety. But this awareness and the increased awareness of many issues change the criteria on which decisions are made.

The wide use of quantitative measures for everything from cattle breeding and feeding to financial analysis and range management have added new complexity to the quantitative analysis part of decision making. The question becomes, how does a cattlemen organize, evaluate and synthesize information concerning all facets of the cattle business into decisions that lead them to the successful achievement of goals? This was the challenge faced by a group assembled in 1995 by the Integrated Resource Management (IRM) Sub-Committee of The National Cattlemen's Association. The group included producers, extension personnel, and scientists representing many disciplines involved in animal production. Their challenge: based on the breadth of knowledge concerning all facets of cattle production, is it possible to build a dynamic model that would help people in the beef cattle industry with decision making?

Predictive decision support tools based on quantitative measures are widely used in industry and government. They are often referred to as "flight simulators", which refers to one of the early uses of these tools, which was to train Army Air-Corp pilots in World War II. Today, "flight simulators" are used in teaching and decision-making in many fields, from flight training to finance. By the late fall of 1995, the IRM group discussing the issues and opportunities concerning the development of decision support tools came to a consensus. Yes, the knowledge and skills needed to build a "flight simulator" for the cattle industry did exist. And yes, it should be built!

But the challenges remained daunting. A decision support tool would mean a new approach for producers to apply knowledge derived from the pool of information generated by scientists through the years. It would require features to include the ability for producers to organize, set priorities, and visualize potential management decisions and evaluate outcomes of these decisions. To satisfy these requirements, biological and economic components of a system would need to be joined, thus allowing for processes contained within each component to affect each other, i.e., allow interactions to occur between components. The structure of a model must promote application by producers. And development of a software application for the beef cattle production system that incorporated biology and economics in a user-friendly package would be needed. Perhaps more importantly, it would mean changing the philosophy of decision-making previously employed by producers to include the use of a decision support tool.

The group concluded that upon completion, the new decision tool should serve multiple functions. First, it should serve as a risk management aid for use by producers to evaluate strategic management decisions. Results stemming from application of the decision support tool would not identify the single best management option rather identify a set of options from which

the producer could select. Secondly, it could be used as a teaching tool in a variety of classroom settings to a wide variety of learners. And third, it could serve research, not only in testing and comparison, but also in discovering leverage points and areas of future investigation.

DECI Becomes a Reality

In 1996, the National Cattlemen's Beef Association (NCBA) passed a resolution (NCBA, 1999) to support development of a management aid to evaluate strategic decisions. A group of individuals within the animal science community initiated the effort. Recognizing the complexity of the project, the development was broken into phases with the first to be the animal component. In May of 1996, the Agriculture Research Service of the USDA (ARS-USDA) committed resources for the completion of the first step; the development of a user-friendly decision support aid to assist cattle producers with management decisions involving only the animal component of the total project.

The project moved rapidly though the development phase. An existing animal production model was updated to current levels of understanding of biology using information from research concerning quantitative genetics, bioenergetics, growth, body composition, and reproduction. The software application consisted of two components, first, visible to the user, a graphical user interface used to input producer information about the animals, feeding, and management policies, and to generate production reports. Secondly, in the background, transparent to the user, a simulation program transforming information from years of animal science research into knowledge for use in problem solving. This understanding was encoded into a simulation model to predict performance of cattle in all phases of the beef industry. The structure of the model maintained a record of herd inventory. Retained measures of productivity include weights and carcass composition of animals sold, conception, calving, and weaning rates. Feed resources consumed by animals could be predicted and summarized. The Decision Evaluator for the Cattle Industry or "DECI" was a reality.

The testing phase occurred in 1997. In April of that year, 20 individuals representing producers, extension, and consultants from around the United States traveled to Clay Center, NE to evaluate and critique the alpha version of the software application. Recommendations were reviewed with most being incorporated into the decision support aid. In December 1997, the NCBA provided a forum for a test of the beta version. Evaluators were a mix of testers of the alpha version plus a group who were seeing the decision support aid for the first time. The software Decision Evaluator for the Cattle Industry (DEC I) version 1.0X was released to the industry at the 1998 annual meeting of NCBA (NCBA, 1998).

Since that time, several changes to DECI have been made. Producer information characterizing the historical production and financial performance of a ranch/farm beef operation is now required for application of DECI. This information results from the use of a Standardized Performance Analysis (SPA) by the individual. The historical information is used to check the values generated by DECI to insure that simulation model is working correctly. Also, Version 2.0X, released in the spring of 1999, contains the postweaning enterprises of backgrounding, stocking, and finishing.

Introduction of DECI to the industry has taken many forms. For example instructors of beef production management classes from more than 25 colleges and universities reviewed the software package during January of 1998 and received further training in August of 1999. These individuals consider the application of a valuable tool for integrating academic information from the animal sciences with decision-making processes. Also, presentations of the software application have been made for a wide range of producer groups, consultants, and academics. What the group of IRM enthusiasts envisioned in 1996 had become a reality.

Future Applications and Challenges

DECI could contribute to the management decision process for all segments of the industry. For example, breeding programs could be developed by seedstock producers to fit the needs of customers from diverse production environments. A seedstock producer in Colorado, in collaboration with a commercial cattle producer customer, could characterize the resources and marketing strategy for the customer and identify the sire with the genetic merit that would best match the commercial producers production goals. Or imagine a bull sale in Nebraska, where a buyer would present information, both production and financial, characterizing the goals, production resources, and marketing options of his or her operation to a seedstock producer. This information would serve as input into DECI, program encompassing all of the interactive components involved in beef production. DECI would allow for the evaluation of management options concerning feed resource allocation, genetic potential utilization, marketing options, and general herd management of the buyers cattle operation. Then, the breeding potentials for all known production traits of each of the sale bulls would then be evaluated within the buyer's production environment. DECI could serve as an integrator of information and predict the performance of the progeny from the different sires in the bull buyer's production environment. Results from this decision support tool would be used to rank sires with regard to economic returns. A sale and corresponding purchase would be made, based on a bull's economic impact to the buyers operation. Risk, associated with the expenditure of financial capital, would be mitigated.

Imagine a classroom at a university, college or technical institute in Wyoming. Students are being taught the principles of beef cattle production, actually managing a real case study of a cattle operation near Sheridan. The principles of management are taught not as singular topics or events but as integrated and interactive components of a whole operation. A student is able to evaluate the impact of a crossbreeding system, or a multitude of other management considerations, not only from a genetic perspective but also from a financial and nutritional perspective over an expanded time frame. DECI can make that vision a reality. Will the student be better prepared to manage a complex cattle operation in the 21st century? Most certainly.

One of the original charges of the IRM group brainstorming about decision support tools was the need for such tools to be dynamic. That is, that the development of a tool be an ongoing process to ensure that the latest information and technology be continually added to the model. The group felt that this was necessary to maintain relevance to an ever-changing body of scientific knowledge as well as to cattlemen faced with new challenges. This remains a major concern. While USDA-ARS has taken the lead, and continues to add sensitivity to DECI with

work on an improved forage component. However, the financial and economic parts of the model need improvement. Who is going to accept responsibility for that work has yet to be determined.

Conclusion

The beef industry is adaptive. Throughout the years, producers working together with industry, university, and government personnel have adapted production practices to meet the needs of the times. With abundant resources and few societal concerns, the objective function adopted in the past was to increase revenue by maximizing productivity, and this resulted in increased profit. In today's production climate, using profit as a goal requires consideration of both expenses and revenue. This increases the complexity of the problem forcing producers to change the focus of the decision-making process to managing risk. This change requires adoption of new problem-solving techniques, coupling biological and economic knowledge with technology to achieve a defined goal. One of these techniques will certainly be the use of decision support tools.

More information concerning DECI may be obtained by contacting either Charles Williams (wi1liams@email.marc.usda.gov) or Tom Jenkins (jenkins@email.marc.usda.gov) at the Meat Animal Research Center, Clay Center, Nebraska.

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