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Economic Value of Managing Genetics—How to capture the value?

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Introduction

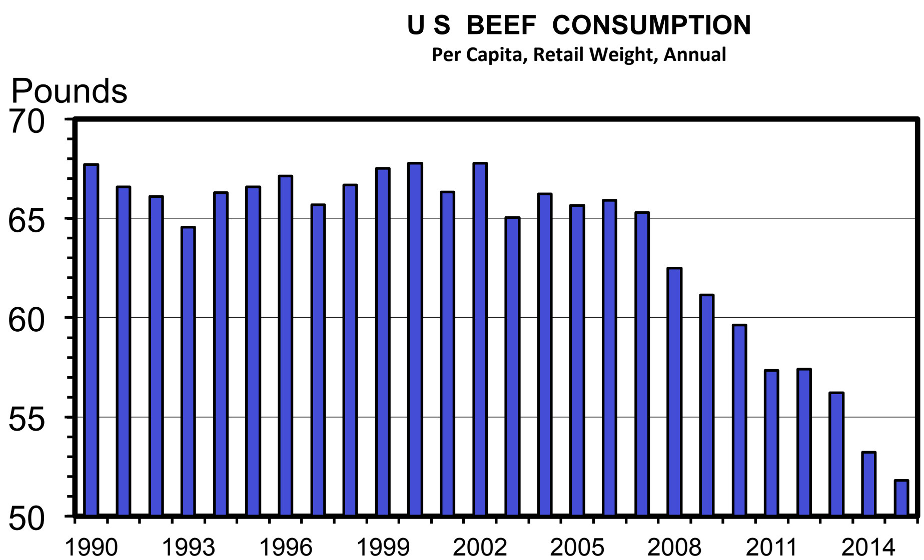
Capturing value from managing beef genetic depends on three key complementary components—genetic management, organization design, and market differentiation. Without complementary changes to organization and market differentiation mechanisms, value from better management of beef genetics may not be fully captured, or beef genetics may be undermanaged. The purpose of this paper is to frame the problem of obtaining optimal beef genetic management as identifying, and employing, complementary organization arrangements and market differentiation mechanisms that reduce transaction costs and facilitate greater beef genetic management. The paper concludes with specific recommendations for northern beef producers to improve capturing the value of greater genetic management.

The problem of obtaining optimal management of beef genetics results from transaction costs in the beef supply chain. Transmission of price signals that incentivizes greater genetic management has been shown to be distorted from transaction costs in a non-integrated beef supply chain; these transaction costs result because of typical market failures that are described in the academic literature, examples include: opportunism for asset specific investment, inadequate risk-sharing institutions, horizon investment problems, specialized human capital required for optimal genetic management, and uncertain product differentiation signals to buyers and consumers. The adoption of a vertically integrated supply chain, as an alternative to the market mechanisms, may reduce transaction costs that occur using the price mechanism; however, vertical integration in the beef chain may result in large "bureaucratic costs" because of the heterogeneity of beef production-- both in scale and geography and in producer financial attributes and objective functions. The existence of bureaucratic costs in either a vertically integrated beef supply chain, or a beef supply chain that relies on improper or mixed price signals, results in sub-optimal investment in genetic management. As a result, there is the opportunity to capture greater value from added premiums, or reduced costs, by adopting greater genetic management in beef production if there are complimentary organization and market differentiation mechanisms (James, Klein, and Sykuta, 2007).

Some gains have been captured from greater genetic management through price mechanisms and an evolution to more market differentiation arrangements and limited vertical integration in the beef supply chain. Despite these efforts, U.S. beef consumption continues to decline in recent years (Figure 1). A possible reason behind the decline is that consumers have been demanding healthier, nutritious, and safer beef (Schroeder & Kovanda, 2003). Moreover, consumers are also demanding that their preferences be met at competitive prices compared to other competing protein sources that are more vertically integrated (Schroeder & Kovanda, 2003).

The beef industry has seen slower to change towards vertical integration versus pork and chicken. Some reasons given are that the cattle sector has a larger genetic pool as compared to the other industries, which adds to the complexity of identifying superior genetic traits. There are also large genetic differences within cattle breeds that add uncertainty to genetic traits and final beef product quality. Another reason given is that the cattle sector has a longer production cycle versus hog and poultry. Also, beef producer's size of operation is typically smaller in the United States, with average herd size just over 40 cows (NASS, 2013), and producers are more dispersed in the U.S. and not concentrated in production regions as seen in the hogs and poultry sector. This is mostly the result that beef production is not done in confinement housing such as poultry and hogs where exogenous environmental factors can be better controlled. In addition, the beef sector varies in objective functions (profits, lifestyle, hobby, etc.) across producers. These factors all combine to add transaction costs, or bureaucratic costs, to a more coordinated beef supply with greater genetic management through integration.

Figure 1. U.S. Beef Consumption (1990 with projections to 2015)



(Source-Livestock Marketing Information Center)

This paper suggests that optimal genetic management may be able to achieve greater aggregate welfare to the beef producer and beef consumer if complementary organization and market differentiation mechanisms are adopted with improved genetic management. The paper outlines how greater value can be captured from beef production, how genetic management can aid in capturing this value, and how complementary organizational and market differentiation mechanisms are necessary.

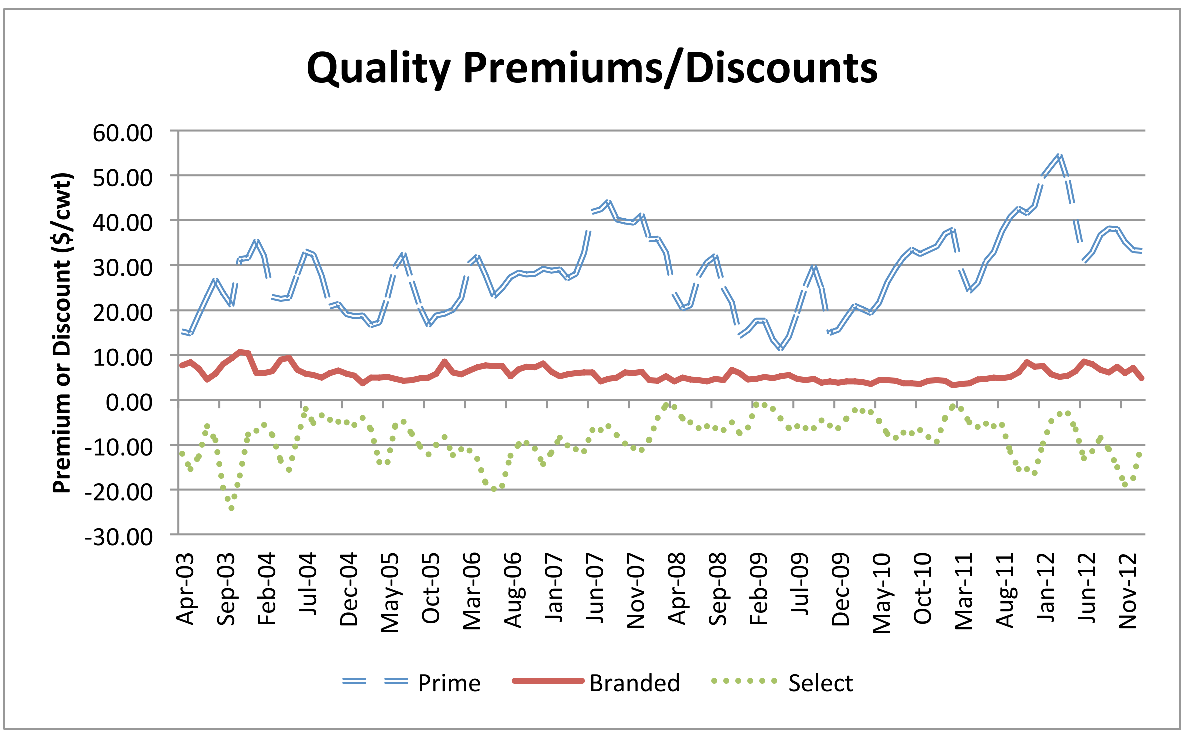
Genetic management can capture more value in beef production

Value from changes in the supply chain can occur from two different sources: 1) from value-added premiums for higher quality beef products, and 2) from better segregation of beef production that increases consistency of products and quality yields. The beef industry competes with the pork and chicken sectors that are more vertically integrated to create consistent, traceable, quality products.

Consumers are demanding and willing-to-pay for high quality, consistent beef. Their willingness to pay for quality beef has been exhibited through higher prime quality grade premiums over recent years (Figure 2). In addition, branded products, such as Certified Angus Beef (CAB), have shown to have strong demand and garner consistent premiums.

In addition to value-added premiums that can be obtained, packer and feedlot capacity can be more efficiently utilized with a coordinated, consistent production system. Utilizing genetic management strategies (proven genetics) coupled with reproductive technologies (such as artificial insemination with estrus synchronization) can aid in coordinating and developing higher quality (production—performance and health, carcass attributes), more consistent, and uniformity in cattle and beef products. This would result in lower costs associated with sorting cattle in the feedlots and carcasses in the packing plants. It also results in reduced costs in processing, transportation, and storage of non-demanded beef products of undesirable quality and consistency.

Figure 2. Quality Premiums/Discounts (based from Choice)



(Data Source- Livestock Marketing Information Center)

Genetic management includes selecting sires and managing dam selection by choosing genetic characteristics (production—maternal and performance, carcass) that optimize the producer's operations goals. Producers can utilize expected progeny differences (EPDs) along with accuracies, ultrasound technologies, and DNA technologies when making herd genetic decisions.

Technology supporting genetic management

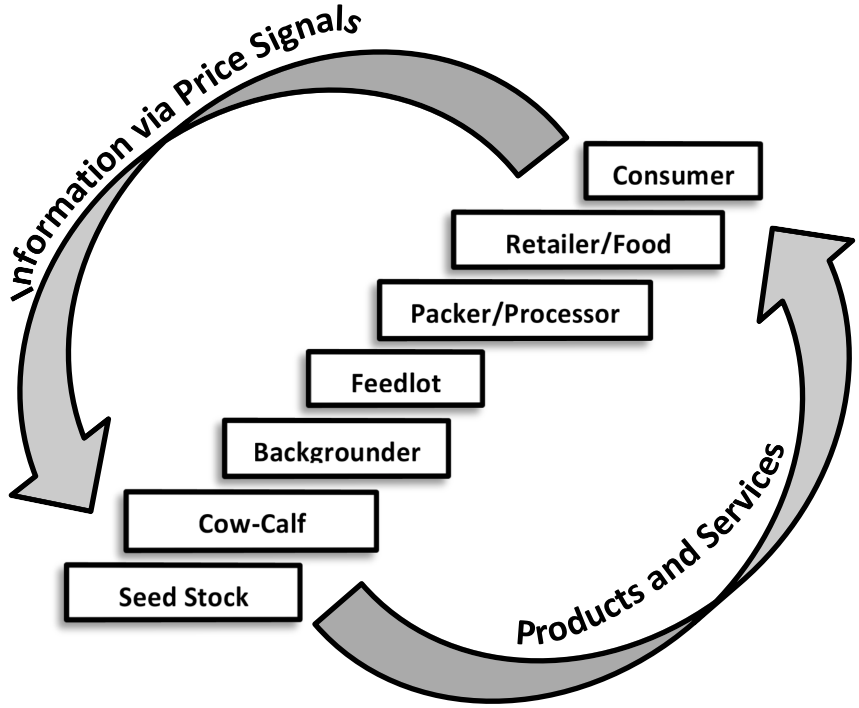
The adoption of artificial insemination (AI) and estrus synchronization (ES) technologies can aid in genetic management through access to superior genetics and coordinating pregnancies supporting calf crop uniformity. Adopting AI allows producers to more quickly improve their herd genetics. "Using high-accuracy proven sire genetics through AI can improve the percentage of calves that grade prime" (Elliott, Parcell, Patterson, Smith, & Poock, 2013, p. 101). For example, Dailey (2012) explained that "twenty-nine percent of the University of Missouri Thompson Farm calves (2008-2011) graded prime using proven genetics", which contrasts with the national average of only three percent of cattle grading prime (as cited in Elliott et al., 2013, p. 101). "The AI and estrus synchronization (ES) technologies can aid in reproductive management in herds. These technologies can increase production efficiency and enhance genetic characteristics that can create higher quality beef. However, the adoption of AI and ES technologies is less than 10 percent in the U.S." (Elliott et al., 2013, p. 101). Other reproductive technologies that can support genetic management such as embryo transplants and sexed semen are even less widely utilized. Adopting technologies is a critical component in augmenting genetic management.

Feedback loop for adapting genetic decisions

Maintaining accurate records on individual animals is critical in adjusting genetic management protocols. Performance and carcass data on animals can be used to make future decisions on genetic selection including sire choice, replacement females, and culling decisions. Tracking and maintaining genetic records start at the seedstock level and continues to the cow-calf producers. However, these segments in the beef value chain depend on performance and carcass data information being shared through the supply chain, so this information can be utilized in making genetic management decisions at each level. In a non-integrated supply chain the information must be sent back using price signals for genetic attributes, as opposed to information being directly shared.

The adoption of technologies takes financial, labor, and human capital investments. Producers have to weigh the costs of investing in technology with the benefits (potential to capture the added-value). The ability to capture the added-value also relies heavily on the type and organization design of the operation and the ability to signal the investment to potential buyers or consumers.

Figure 3. Beef Supply Chain--Information and Product Flow



(Adapted from Schroeder & Kovanda, 2003)

Beef Supply Chain and Evolving Organizational Arrangements and Market Differentiation Mechanisms

Currently, the beef industry is less coordinated and integrated as compared to the pork and poultry industries. However, there has been some evolution towards more limited integration and utilizing more market differentiation mechanisms to improve genetic management in beef production. This is evidenced by the increasing number of beef alliances and the increase use of beef branding that has occurred in the beef supply chain. Sporleder (1994, p.533) defines strategic alliances as "purposive strategic relationships between independent firms that share compatible goals, strive for mutual benefits, and acknowledge a high level of mutual dependence" (as cited in Gillespie, Bu, Boucher & Choi, 2006). These alliances can be horizontal and/or vertically coordinated across the supply chain. Schroeder and Kovanda (2003) found that the fed cattle marketed through alliances had increased from 8% in 1996 to 27% in 2001 to 39% in 2006. Schroeder and Kovanda (2003) indicate that number of head marketed through alliances can range greatly with some alliances being smaller in nature, while some may market as many as 200,000 head per year. Schroeder and Kovanda (2003) point out that the largest beef alliances including Certified Angus Beef (non-equity alliance, based upon licensing agreements) made over 5% of the total fed cattle marketing and U.S. Premium Beef (new generation cooperative) made close to almost 2% in total fed cattle slaughtered from 2000-2001.

Alliances are an organizational form that is between spot markets and vertical integration. These alliances are typically seen in five categories as outlined by (Gillespie et al., 2006): breed, commercial, natural/implant free, cooperative, and calf marketing. These alliances can take many forms whether they are cooperatives versus non-cooperatives and differ on member compensation, risk sharing, and equity vs. non-equity based (Purcell & Hudson, 2003). These alliances can provide products benefits by including bulk purchasing of inputs, reducing transaction costs (commission fees, trucking—pooling cattle), information sharing (best management practices, carcass and performance data), and more value-based pricing for products (e.g., grid pricing formulas).

There has also been an evolution to more market differentiation mechanisms. These market differentiation mechanisms include brand awareness strategies that efficiently signal to buyers/consumers quality and consistency of products. For example, the Show-Me-Select Heifer (SMS) Replacement Heifer program signals Missouri producers use of specified protocol on genetics, management, and production in order to be sold in SMS sales. "The program changed in 2008 when a higher heifer quality standard, known as the Tier II, was created. Tier II heifers have the same quality standards as heifers from previous years, but they have additional quality criterion wherein minimum EPD accuracies for the heifer's sire must be met. If the heifer's sire meets the EPD accuracies along with the heifer meeting the traditional requirements, the heifer can be sold as a Tier II heifer. However, if the heifer does not qualify for the Tier II classification, she can still be sold as a SMS heifer if she meets the other basic requirements." (Elliott, Parcell & Patterson, 2013, p. 260-261). "Managing the heifer's paternal side genetics by selecting a sire with maximum EPD accuracies can increase the probability of creating a higher quality offspring" (Elliott, Parcell, & Patterson, p. 261). Elliott, Parcell, and Patterson (2013) found that "in 2008 a discount of $78.42 per head was shown, whereas positive premiums of $32.72 and $111.47 occurred in 2009 and 2010, respectively" for Tier II heifers (p. 272). Another example of a market differentiation mechanisms is Verified Beef's (partly owned by the Montana Stockgrowers' Association) "Reputation Feeder Cattle" program. This program provides a valuation utilizing genetic merit to estimate average daily gain, carcass weight, feed per gain, ribeye area, and USDA Yield and Quality Grades (Maday, 2013). This program provides producers with third party verification of genetics (along with other management information) and one valuation of their genetics (based on the difference to an established baseline).

The efficiency that buyers can be aware of the technology investment and assured of the product is an important part of capturing value. Market differentiation mechanisms need to clearly communicate with buyers the product that is being sold and give assurance (third party verification, internal monitoring) to buyers that the product is associated with the perceived management investment. Confusion can be created by poor marketing terms that degrade the value of the program. For example, buyers may have considered the Tier II in the SMS program was actually an inferior product compared to Tier I because of the word association with quality levels, though Tier II was meant to indicate a superior product. Efficiency in communicating new genetic protocols (e.g., genetic selection indices) or management techniques can add value to your cattle when there are adequate market differentiation mechanisms that effectively communicate consistent product information to buyers and consumers. This may require a large initial investment in advertising or other marketing methods to educate buyers on the potential benefits of a new value-added product.

Conclusion---Opportunities for Northern Plains

In order to more fully capture the added-value through genetic management, complementary organizational forms and market differentiation mechanism must be utilized. These two components can facilitate greater technology adoption. A critical component of any organizational design form is that it is complemented with regular information flow and feedback through all sectors of the supply chain. This information flow depends on records and performance information being shared through the supply chain, either through efficient, clear price signals, or from information and value-sharing in more integrated supply chains.

Complimentary organization arrangements and differentiation mechanisms can be obtained more readily when participants are more similar in their production management characteristics. The similarity in production attributes results in lower bureaucratic costs from vertical integration, and facilitates coordination in technology investment that captures greater value than a price mechanism with distorted price signals. Several attributes of the Northern Plains beef producers may be conducive for further beef alliances to be developed, or more vertical coordination that can be implemented to achieve greater value.

<u>Potential for Northern Plains-</u>

1.) Feedlots moving northerly
2.) Higher technology adoption rates
3.) Higher cattle quality
4.) Larger operation size
5.) More readily kept records

These factors include that feedlots have been moving more northerly where more direct communication between from packer to seedstock producers can occur. Moreover, the Northern Plains already has a higher rate of adoption of genetic and reproductive technologies compared to the Southern Plains. In addition, the northern region has been shown to have overall better quality cattle (TAMRC, 1996 as cited Schroeder et al., 1997) and the producers more readily maintain individual animal records. Also, operation sizes are larger in the Northern Plains.

The following recommendations should be discussed with beef stakeholders in order to identify potential new strategic alliances or organizational forms that can improve the economic welfare to all supply chain segments, including consumers.

Recommendations for capturing added-value through genetic management-

1. Improve genetic protocols (provide transparency)
2. Be creative—think about new possible strategic alliances (including proper feedback mechanisms)
3. Identify producers to partner with that have similar operation and genetic management characteristics
4. Market differentiation (clear and transparent)
5. Identify new, efficient, organizational arrangements and market differentiation mechanisms that are complimentary to greater genetic management
6. Identify genetic management technologies that need to be developed in order to capture more value

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