# DEVISING AN EFFICIENT BEEF SUPPLY CHAIN: ALIGNMENT OF PRODUCT AND FUNCTIONS

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## ABSTRACT

Compared to many non-agricultural industries, the development of the beef supply chain is still at its infancy. As the beef industry endeavors to improve its supply chain operations, it would be beneficial to benchmark more advanced non-agriculture supply chains such as grocery, automobiles, and computers. This paper provides a comprehensive review of the current development and practices of the beef supply chain. Based on Fisher's (1997) suggestion, we reviewed the nature of beef supply chain in terms of its product and functions. We then examined current practices of beef strategic alliances from the aspects of supply chain structure, product flow, financial flow, and information flow. Several examples of supply chain practices from non-agricultureal business were offered. Finally, challenges and suggestions for developing an efficient beef supply chain with the alignment of product and functions were summarized.



**Keywords**: Beef industry, Supply chain management, Strategic alliance, Agricultural supply chain


## 1. INTRODUCTION

Demand for beef and its market share of total meat consumption declined substantially over the last two decades. Per capita beef consumption decreased significantly from 76.6 pounds in 1980 to 67.4 pounds in 2002 while consumption of total meat increased from 195.1 pounds to 219.3 pounds per capita. Facing competition from the chicken and pork industries, the market share of beef dropped from 39.3% to 30.8 %. Figure 1 displays the declining trend of beef demand indicated by the demand index from 100 in 1980 to 56 in 2002.

***(Insert Figure 1 here)***

In addition to the strong competition from other meat products, beef also faces challenges from other factors, such as a relatively high price, health and food safety concerns, quality consistency, and changes in life style (Boetel and Liu, 2003; Lamb and Besear, 1998; Katz and Boland, 2000). Regardless of what factor is concerned, the challenges cannot be overcome by individual industry segments (Lawrence and Hayenga, 2002; Smith, 2001). In order to improve its operations and quality and regain the faith of consumers, the beef industry must strengthen collaboration of all participants in the supply

chain. As other non-agricultural industries have successfully demonstrated, such collaboration would increase the competitiveness of the supply chain through improvement of product flow, financial flow, and information flow among segments (Bowerbox, Closs and Cooper, 2002).

The beef industry has recognized this need and has engaged in developing strategic alliances to improve its supply chain management (SCM). Many studies (Anton, 2002b; Lamb and Besear, 1998; Sartwelle, Davis, Mintert, and Borchardt, 2003; Schroeder and Kovanda, 2003; Ward, 2000; Yelich, 1997) have discussed the concept, types and characteristics of strategic alliances in the beef industry. However, little has been done to systematically examine the current beef supply chain effort in light of previous experience from other industries. The concept of SCM does not guarantee success by itself (Fisher, 1997) and managers have to be cautious with their efforts and investment in developing supply chains. Moreover, supply chain management has been well developed and practiced in non-agriculture industries such as computers, grocery, automobiles, etc (Bowerbox, Closs and Cooper, 2002). The beef industry should be able to learn from those industries in directing its effort and investment in supply chain management.

The purpose of this paper is to apply an integrated approach to analyze the beef supply chain and strategic alliances. We review the nature of beef supply chain in terms of its physical function and examine the current development of strategic alliances from the aspects of supply chain structure, product flow, information flow, and financial flow. This review will provide valuable suggestions for improving the current beef supply chain operations and for resolving some of the problems the industry currently faces. In the remaining portion of this paper, we will first describe the nature, structure, and characteristics of the beef industry followed

by a discussion of current practices in strategic alliances. The effectiveness of current strategic alliances in solving industry problems such as quality and pricing are examined. Various issues pertaining to strategic alliances development are discussed and finally suggestions for improving beef supply chain management are presented.

## 2. BEEF SUPPLY CHAIN: PRODUCTS, FUNCTIONS AND STRUCTURE

SCM involves the integration of all the value creating elements in the supply, manufacturing and distribution process, from raw materials, through the production process, to customer consumption. In a supply chain, materials, information and financial flow from suppliers to manufacturers, distributors, retailers, and then to consumers. SCM emphasizes the coordination of those flows within and among all supply chain parties. The ultimate goal is to successfully reduce costs and inventory while effectively delivering the right products to the right customers with the right amount at the right time. Many companies have successfully improved their competitiveness applying the concept of SCM (Bowerbox et al., 2002).

### *2.1 Beef – A functional Product*

Fisher (1997) suggests that not all supply chain systems are the same, and they should be managed differently. He classifies all products into two categories, functional and innovative, from aspects of product life cycle, demand predictability, product variety, lead time, and profit margin. Examples of innovative products are computer chips or fashion skiwear, while canned soup and beef products are functional products. Each type of product has unique characteristics, faces different challenges, and therefore requires different emphasis to manage its supply chain systems. For functional products, such as beef, minizing physical costs (including production, transportation and other transactions) is crucial. The primary function of supply chain management is “physical efficiency”, which

aims at reducing inventory, maximizing production utilization and sharing information among segments to meet relatively predictable demand at the lowest cost. In constrast, innovative products must develop a "responsive" supply chain emphasizing manufacturing flexibility, buffer capacity, lead time reduction, product variety, and fast market response. Figure 2 displays the taxonomy of products and supply chain systems. How well firms devise their supply chains to match with their products is important to ensure the success of their supply chain systems. This paper examines the current development and practices of the beef supply chain based on the perspective of this framework.

***(Insert Figure 2 here)***

***2.2 Beef Industry***

The U.S. beef supply chain consists of eight distinct segments: seedstock breeders, cow/calf producers, stocker operators, feedlot operators, packers, processors, retailers, and consumers (Figure 3). Each segment performs a particular function in the market. Seedstock breeders supply breeding animals, semen, and embryos. Cow/calf producers, also known as ranchers or commercial cattlemen, maintain cow herds and supply weaned calves. Stocker operators, as backgrounders, graze cattle until they are yearlings, generally between 10 and 16 months of age. Feedlot operators, as feeders, feed cattle high-energy finishing rations for 4-6 months. Packers slaughter live animals and cut the carcasses which are subsequently put in boxes for shipping, also known as boxed beef. Processors cut boxed beef into products to satisfy the retailer's requirement or consumer's demand. Retailers (including foodservice) buy boxed beef and perform meat cutting, or purchase the retail cut directly from packers or processors. Finally, consumers purchase and consume beef products. These segments link together and form a supply chain that performs the

functions of production, distribution and marketing.

***(Insert Figure 3 here)***

Traditionally cow/calf producers, feedlot operators, and packers seek to maximize their individual profits. The degree of industry concentration from cow/calf to the packer segment increases with a large number of small-scale cow/calf producers (Salin, 2000). More than 720,000 cow/calf producers have less than 100 head of cows in the U.S. (U.S. Department of Agriculture, 2003). A small number of feedlot operators (16,500 total feedlots – U.S. Department of Agriculture, 2003) purchase cattle from many cow/calf producers. There are only a few large packers who are highly integrated with processors. For instance, the four major packers, Tyson-IBP (Iowa Beef Packers), Swift & Company (formerly ConAgra Beef), Excel and National Beef, slaughter approximately 80% of U.S. fed steers and hiefers.

Compared to supply chain systems in other industries, there are some unique challenges presented in beef supply chain. We discuss those unique challenges from the aspects of supply chain structure and the flows of product, information and finance. First, the industry consists of a large number of unorganized parties and coordination between them has been lacking. A large number of ranchers and feedlot producers are dispersed across wide geographic areas, which makes coordination extremely difficult. In addition, the relationships among segments have traditionally been adversarial in part a result of intensive negotiation over cattle prices and volatile margins over time. Overall, the lack of coordination and antagonistic vertical relationships make cattle production difficult to respond to the market changes.

The lack of coordination also causes product flow problems in the beef supply chain. Specifically, producers did not receive clear economic signals to help them develop

production plans based on market demand. The mismatching of supply and demand often forced feeders to carry too much inventory, which resulted in significant lengthy production cycles over time and created facility utilization inefficiency. In general, product flow was not sychronized with market demand. A relevant issue pertaining to satisfying market demand was establishment of branded beef products. Generally, retailers did not believe in the value of a brand name for beef and did not place emphasis on branded products (Pearcy, 1999). Branded products provide consumers additional information about the product such as enhanced food safety assurances and consistently high quality (e.g., tenderness guarantees). As consumers realize the merits of branded products, they are willing to pay premiums, which happened in the poultry industry.

The third unique problem in beef industry is related to information flow. Specifically, ranchers and feeders rarely receive information of carcass quality or consumer preferences. This is especially true when fed cattle are sold on a live- or dressed-weight basis. Without necessary information feedlot operators cannot improve feeding operations to increase cattle quality, and ranchers cannot select appropriate genetic breeds to meet market demand. Furthermore, verifications of beef quality and safety protocols for consumers are also unavailable. The last challenge to the beef supply chain comes from financial flow or pricing of beef. Traditionanlly, feedlot operators negotiated selling price for finished cattle with packers face to face when cattle were sold (Schroeter and Azzam, 2003). These transactions for individuals pens of cattle were made at an average price, often termed “pricing-on-the-average” (i.e., all animals brought the same price per pound regardless of quality differnces). There were no economic

incentives for producers and feeders to raise high quality cattle.

Overall these problems have made the design of an efficient beef supply chain difficult. Long production lead times and lack of coordination have created various problems for all participants in the beef supply chain. Specifically, feeders frequenly carried too much inventory, packers underutilized production facilities, production and logistics costs were high, and consumers were not getting good quality beef products at a competitive price. Anderson and Trapp (1999) estimated that beef processing costs could be reduced as much as $5/head if packing plant capacity utilization could be improved by a better balance between demand and supply. In short, the beef supply chain could not display all necessary functions to be an efficient supply chain (see Figure 2). Recognizing the problems, the beef industry has begun to develope strategic alliances to improve the efficiency of its supply chain. The next section reviews how the current development of strategic alliances attempts to deal with these challenges.

## 3. CURRENT DEVELOPMENT OF BEEF STRATEGIC ALLIANCES

A strategic alliance is an association of various supply chain participants aiming at fostering collaboration through vertical affiliations. Currently estimates suggest the beef industry has approximately 60 alliances, with most of these developed since 1990 (Ishmael, 2002b; Schroeder and Kovanda, 2003). Beef strategic alliances can be categorized into one of four different segments of the industry with different emphasis (Anton, 2002b; Yelich, 1997; Sartwelle et al. 2003). Breed association-sponsored alliances focus on purebred cattle, or the cattle to meet genetic requirements. Natural/implant-free alliances emphasize the features of assured production processes to meet niche markets. Cooperative alliances apply value-based pricing to encourage their

members to raise high quality cattle to meet market demand. Finally, commercial alliances provide grids or marketing arrangements for producers to target high-quality or red meat yield beef.

Table 1 summarizes the practices of the beef strategic alliance from the perspectives of supply chain structure, product flow, financial flow, and information flow.

***(Insert Table 1 here)***

**(1) Supply chain structure.** Generally current strategic alliances are formed around four combinations of segments: seedstock or cow/calf producer, feedyard, packer, and retailer/food service distributor (Ward, 2000). Horizontal alliances involve multiple parties from the same segment of the supply chain, whereas vertical alliances comprise parties from different stages. The focus here is on vertical alliances.

**(2) Product flow.** Beef strategic alliances attempt to match supply with demand by enhancing the coordination between packers and producers. For example, based on the demand information from packers, producers are required to make delivery commitments to packers. Such delivery commitments enable packers to assure capacity utilization in processing plants, and to control the flow of beef products, which benefits all participants by reducing costs. Currently, about 44% of alliances require that a minimum of one cattle be delivered, while 24% require 70 head or more to participate (Ishmael, 2002b).

Another improvement strategic alliances have made in product flow is matching beef supply with increasing consumer demand for high quality beef. High quality beef depends on better management of ranch or feedlot operations such as genetics, sorting strategies, injections, feeds, etc. Most strategic alliances have begun to impose requirements of weaning and preconditioning on producers and provided necessary support to improve beef quality (Ishmael, 2002b). For instance, Ranchers Renaissance has genetics

specifications of "prefer a minimum of 50 percent English and maximum of 50 percent Continental breed influence." Those requirements have gradually improved the consumer demand for high quality beef, which ultimately enabled the development of branded beef products. Currently over three-fourths of alliances target branded products (Ward, 2000). As an example, U.S. Premium Beef's partner, Farmland National Beef, has developed branded products such as Farmland Black Angus Beef (FAB).

**(3) Information flow.** Food safety and beef quality rely on the availability of information such as verifications of sources (e.g., ownership, location), process (e.g., vaccination, growth enhancers, and pesticide treatments) and genetic information. More than half of the alliances require source verification of an animal. Some alliances go even further to provide process and genetic information to share with all supply chain segments. Alliances also provide beef producers with carcass data to improve herd management (Ward, 2000). About 74% of the alliances are capable of utilizing the electronic ID (EID) to record data such as sex, weight, and vaccinations in ranchers and feedlots. The feeding, growth, and carcass performance are now better traced. Information technology has enhanced the efficiency of information flow that is definitely a critical component for a successful alliance.

**(4) Financial flow.** Most alliances offer a grid pricing method to reward and encourage producers to raise high quality cattle. Over 82% of the alliances in the Beef Magazine list utilized grids that were geared to quality grade (QG) or yield grade (YG) or both. Over time the pricing mechanism has been changing to increasingly pricing individual carcasses based on their merit (quality and yield grade). Grid pricing represented about 45% of fed cattle sales in 2001 (Schroeder et al., 2002). Through grid

pricing, consumer preferences and market conditions can be communicated across the supply chain.

In summary, strategic alliances developed functional or vertical coordination and collaborative relationships among supply chain segments. A value-based pricing system, such as grid pricing, was implemented to encourage better quality cattle with premiums. The price signal and carcass data enabled cattle producers to improve herd management and thereby improve beef quality and revenue. Delivery commiment has improved production efficiency and reduced inventory. Figure 4 displays how strategic alliances enhance the product, finances and information flows in the beef supply chain systems.

***(Insert Figure 4 here)***

The development of beef strategic alliances has improved the efficiency of beef supply chain. Ishmael (2002b) pointed out that there were 4.7 million head of cattle, or 12.84% of total slaughtered cattle, marketed through 34 consumer-based alliances in 2001, a 20% increase over 2000. In addition, based on results of a survey conducted in 2001 in Kansas, Texas, Nebraska, and Iowa, 11% of respondents were involved in alliances in 1996. The participation percentage soared to 45% by 2001, and it is expected to increase to 55% by 2006 (Schroeder et al., 2002). Major motives for joining alliances were found to be acqusition of quality and yield grade premiums and detailed carcass data. Beef alliances also contributed to the development of branded products, which in turn increased beef demand (Mintert, Schroeder and Marsh, 2002). For instance, the retail beef demand index increased from 50 in 1998 to 55 in 2002. During the same period, per capita beef consumption increased from 66.7 pounds to 67.4 pounds, even though the retailed price increased from $2.87 to $4.28 per pound. Overall, beef producers have gradually recognized the efficiency and benefits of

strategic alliances and are willing to deliver their cattle through strategic alliances.

Despite contributions to the beef industry, not all strategic alliances are successful. AgWeb News (Jan. 15, 2003) reported that of 52 working alliances or cooperatives, some were prospering, some were struggling, and some were recessing or just hanging on. This indicates that the the industry still has many challenges in developing successful strategic alliances. Furthermore, Anderson and Trapp (1999) estimated that beef processing cost could be reduced as much as $5/head if the capacity utilization rate can be improved by a better balance between demand and supply. Apparently beef strategic alliances still have room for improvement. The next section discusses what the beef industry can do to develop a even more efficient supply chain system, as suggested in Figure 2.

## 4. DEVISING AN EFFICIENT BEEF SUPPLY CHAIN

The suggestions for devising an efficient supply chain are again organized by supply chain structure and the three types of flow. Most suggestions are made based on previous experience from supply chains in other industries.

### ***4.1 Supply Chain Structure***

Establishing and managing the relationship with supply chain partners is the most critical task in ensuring success of supply chain systems (Handfield and Nichols, 2002). For a functional product like beef, the opportunities of reducing physical costs come mostly from collaboration among partners. Some current beef strategic alliances have not been able to develop trust and communication to cut physical costs throughout the entire chain. For example, many of Ranchers Renaissance's producers disagree with packers regarding the value of source verification (Pearcy, 1999). Future Beef Operation (FBO) failed to develop a vertically

coordinated supply chain due to the lack of support from its partners (Ishmael, 2002a).

One way to enhance the partnership is to establish ground rules, which would provide day-to-day guidelines and avoid or reduce conflicts. For example, the alliance must provide participating producers with production specifications or procedures to ensure quality consistency. Furthermore, regularly collecting participants' comments will also promote communication among all participants. Most importantly, the underlying foundation of beef strategic alliances must be enhanced with trust between producers and packers, where great potential of cost saving exists (Anderson and Trapp, 1999). The beef industry can certainly benchmark other non-agriculture industries (e.g., grocery and computers) in regard to converting a traditional adversarial relationship into a collaborative relationship (Magretta, 1998; Handfield and Nichols, 2002). For example, the "road map to trust" developed by Whirlpool and its steel suppliers is a good model for the beef industry to follow. In this partnership, Whirlpool changed the traditional emphasis of minimizing the price paid per ton of steel to working with its suppliers, removing cost out of business processes. CEOs made long term commitment to the partnership and initiated several cost reducton and profit sharing programs with its suppliers. In a similar fashion, Dell established trust with both its suppliers and customers through long term contract, information sharing, and many creative value-added programs. Such trust allows for eliminating duplicated operations, reducing inventory with small and frequent deliveries, engagining in profit sharing programs, and assessing to timely demand information. Utlimately, Dell has been able to operate in a more efficient supply chain system.

### ***4.2 Product Flow***

As the result of merger and consolidation in the retail industry, four major retailers

(Kroger, Safeway, Albertsons and Wal-Mart) gradually began to play important roles in the beef marketing channel, and they could demand mass quantity of beef delivery. Ishmael (2002b) noted that it would be challenging for beef alliances to provide retailers with a promised volume of branded beef, especially in the situation of sales promotion.

To deliver sufficient amounts of beef products to retailers in a timely manner, the beef industry must improve its current coordination of operations across the supply chain. The "push-pull" strategy that is successfully used by Dell can be applied (Magretta, 1998). Specifically, the stage between packer and retailer could implement pull strategy, and the linkage between producer and packer could apply push strategy. Pull strategy is demand driven, and its objective is to match and satisfy beef demand. On the other hand, push strategy is forecast driven with the objective of reducing cattle production uncertainty and of maximizing efficiency. Under this approach, packers play a major role in coordinating and matching the demand and supply. Packers should supply beef products to retailer with shorter lead times and higher quality products. Meanwhile, packers should also provide cattle producers with demand forecasts to ensure steady cattle flow.

The beef industry can also take a lesson from Campbell to deal with product flow problems due to sales promotion in retailing stores (Ishmael, 2002b). Sales promotion has negative impact on physical efficiency of a supply chain, since retailers could produce a big spike in shipment by "forward buying", stocking up low-priced inventory. Campbell worked out a deal with its retailers in such a way that retailers decided to eliminate unpredictable promotion and offered Cambell with more predictable demand in exchange for good product, low inventory, and reasonable prices in the long term.

The beef industry should also begin to assess consumer preferences by conducting frequent market research. It is important for the industry to understand consumer demand for various products such as lean beef, organic beef, and pasture-finished beef. Understanding customer preference will allow an alliance to make realistic production plans or to develop new products.

Another suggestion for beef production and delivery is related to food safety and quality. The Food Safety and Inspection Service division of USDA proposed the application of Pathogen Reduction/Hazard Analysis and Critical Control Point Systems (HACCP) Rule in beef industry (Hulebak and Schlosser, 2003). Many believed that HACCP is effective to ensure food safety in ranches, feedlots, slaughterhouses or beef processing. To regain consumers' confidence, the beef industry should establish this HACCP system in all supply chain segments and require its strict implementation by all participants.

***4.3 Information Flow***

The beef industry has to develop an information flow to minimize physical costs and to ensure beef quality. The current information flow to assist herd management, improve relationship between partners, enhance quality and safely management, reduce costs and risks has not been well established (Salin, 2000). Particularly, lack of information sharing between segments created tension or duplicated expenses between partners. Producers could not efficiently manage their herd production without carcass information. Without demand information from retailers, packers tend to store too much inventories but could not effectively respond to market changes.

Another approach to enhance information flow is to apply a labeling system that could effectively and efficiently track beef information, such as where animals are born, reared, slaughtered, and processed. A reference number for tracing beef back to its

origin should be provided (van Dorp, 2003). Several approaches are possible to enhance information transparency and to improve information flow. EID and barcode technologies would display more detailed beef information for consumers. For example, EID could collect the source and genetic data that is the base of beef information. Then packers could integrate the data in EID and processing verification to make barcodes. Barcode technology would then be used to track the information of beef products.

In addition to increasing the use of information technology, the beef supply chain must integrate the entire information system, linking producer to retailer and harmonizing the actions of participants. For example, retailers could pass the market information to packers for inventory and branded products management. Through an integrated information system, packers could quickly fill retailers' orders. Packers also could transfer carcass information to producers to improve ranch or feedlot management. Both Electronic Data Interchange (EDI) and XML (eXtensible Markup Language) should be adopted to facilitate the communcation among supply chain members (Salin, 2000). Mintert et al. (2003) illustrate such a system of a beef packer supplying important electronic information to cattle feeders.

### ***4.4 Financial Flow***

The biggest issue in the financial flow aspect is pricing. Currently, beef producers face big risks of variation of base price, premiums and discounts in the grid pricing (Ward, Schroeder and Feuz, 2002; Schroeder and Ward, 2002). As grid pricing gradually prevails, the price of high quality cattle traded through alliances increases. In the meantime, the spot market will continue to trade beef products with lower quality and thus lower prices. Consequently, establishing base prices according to the spot market would no longer reflect the true price of the majority of cattle. Use of wholesale boxed beef prices plus hide

and offal values to establish base prices is a better alternative than spot market formulas.

Moreover, development of more objective means of beef quality and red meat yield must be pursued. Currently USDA quality and yield grades are assigned subjectively by USDA graders. Not only is the subjectivity subject to error, but even worse is that USDA quality grades are poorly correlated with consumer eating satisfaction. Continued efforts to develop technology that objectively measures quality issues consumers care about (e.g., tenderness) and accurate predictors of red meat yield are essential.

To reduce the financial risks at producers' side, alliances might set up operations standards to assist producers to undertake active herd management and reduce carcass variation. Cattle could be sampled before being delivered to analyze herd performances, which allow producers to adjust herd management to match carcass requirements. Producers also could sort cattle into different alliance programs and spot markets based on the quality of cattle. Use of technology like ultrasound to predict optimal finish points appears to offer considerable promise. Eventually, some sort of criteria must be established to examine the rationality of current price structure.

Finally, the beef industry should promote the concept of total cost management, which emphasizes programs leading to cost reduction of the entire supply chain. As demonstrated by many other non-agriculture businesses, supply chain partners can work together to reduce costs for everyone and provide better pricing for consumers (Handfield and Nichols, 2002). As the beef supply chain begins to establish partnership, there will be many opportunities for reducing physical costs across the entire supply chain. For instance, uniform cattle provided by cow/calf producers could reduce the management cost in feedlots. With support

from feedlots, there is a steady and sufficient volume of cattle for packers to enhance plant capacity utilization and to reduce costs. Moreover, if packers and retailers cooperate, packers could reduce inventory cost and retailers could provide better services for consumers. Obviously, such cost saving cannot be achieved without believing in the spirit of the total cost of the entire supply chain. Table 2 summarizes the challenges and suggestions for future development of the beef supply chain.

***(Insert Table 2 here)***

## 5. CONCLUSIONS

Supply chain management offers the beef industry opportunities to deal with the pressure of declining demand and competition from pork and poultry industries. Better coordination and collaboration will reduce beef cost associated with production, processing, and distribution in the value chain (Underhill, 1996). Nonetheless, the concept of supply chain management does not work by itself, since many firms failed to benefit from it. Similar to other industries, the development of a beef supply chain takes time and requires careful planning. In the process of developing an efficient beef supply chain, all members have to switch the traditional emphasis of individual gains to global optimization (Hamblen, 2004). Previous studies have suggested that supply chain systems should be designed with alignment of the nature of products, such as product life cyle, demand uncertainty, product variety and so on.

We defined beef as a functional product, which requires an efficient supply chain with emphasis on reducing physical costs, improving product quality, and balancing demand and supply. Based on the perspective of supply chain efficiency, this paper provided a comprehensive review of the current development and practices of the beef supply chain. We examined the effect of strategic alliance on the supply chain structure,

product flow, financial flow, and information flow. Overall, beef alliances provide a platform for all participants to collaborate and respond to market demand better. However, many issues remain to be solved in order to for the beef industry to compete with pork and poultry products and to increase consumer demand. We made suggestions to improve efficiency of beef supply chain management based on the experience from other industries.

This paper attemps to deliver an important mesage – the beef supply chain must be continuously re-examined and developed with an integrated approach. The industry must combine concerted efforts from all segments to improve coordination and collaboration, considering the nature of beef products and supply chain functions (Hamblen, 2004). The current development of the beef supply chain is still in the early stages, facing many challenges that other more advanced supply chain systems have previously encountered. We firmly believe that the beef industry can learn from non-agriculture industries such as automobile, computers and grocery to improve its supply chain management. Future studies should extensively benchmark supply chain practices aiming at improving the product flow, information flow and financial flow. Meanwhile, the industry should also review mistakes other industries made regarding the mismatching of products and supply chain functions. A more systematic, rather than sporadic, approach to develop the beef supply chain is necessary to improve its competitiveness.

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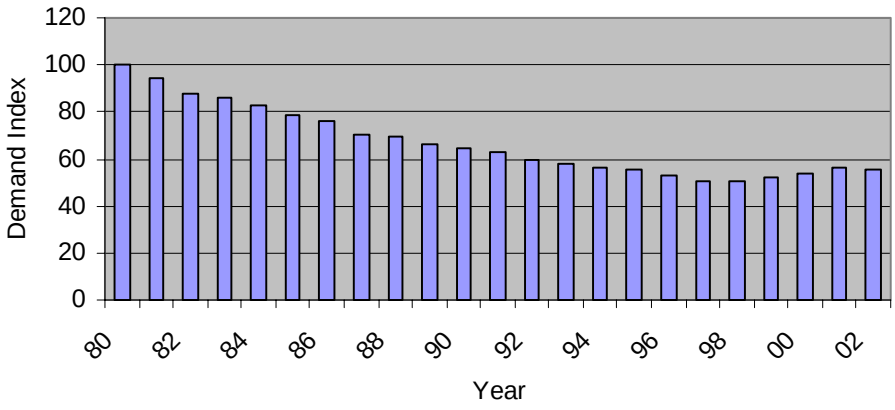
Figure 1. Trend of Retail Choice Beef Demand Index




Source: USDA and K-State Research & Extension,
http://www.agmanager.info/livestock/marketing/default.asp

* The demand index is calculated by assuming a constant elasticity of demand of -0.67 and shifting the demand curve vertically each year then dividing the price that corresponds to the 1980 quantity demanded on the new demand curve by the 1980 price. For example, an index value of 60% in 1993 indicates that in order to sell the same amount of beef per capita in 1993 as was sold in 1980, the 1993 price would have had to been 60% of the 1980 price.

**Figure 2. Defining Beef Supply Chain**

| | ***Functional Products*** | ***Innovative Products*** |
|---|---|---|
| ***Efficient Supply Chain*** | **MATCH** Beef<br>**Product**: predictable demand, long life cycle, low product variety, long lead time, etc.<br>**Supply chain function**: minimize physical cost, maximize production utilization, minimize inventory, etc. | **MISMATCH** |
| ***Responsive Supply Chain*** | **MISMATCH** | **MATCH**<br>**Product**: high demand uncertainty, short life cycle, high product variety, short lead time, etc.<br>**Supply chain function**: emphasize speed & flexibility, maximize reponse, deploy capacity buffer, etc. |

**Figure 3. Structure of Beef Supply Chain**

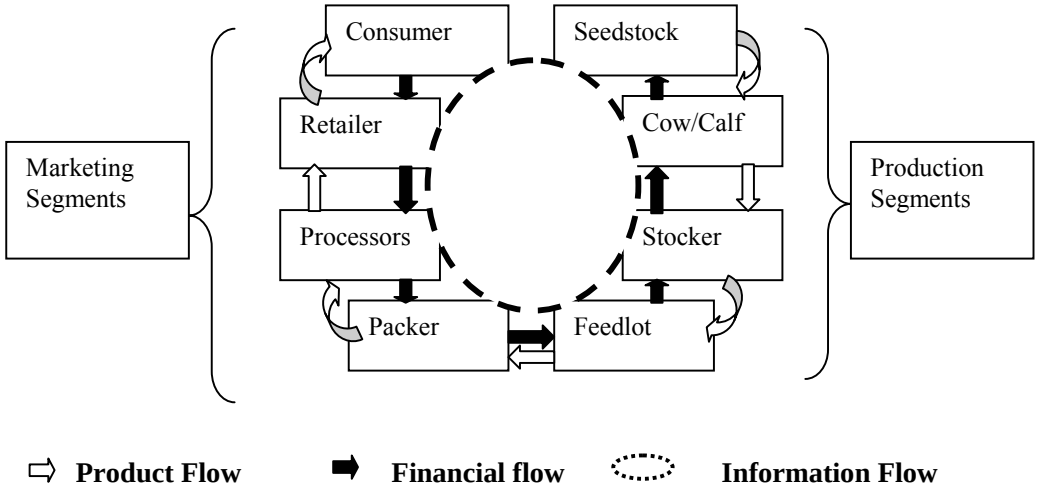
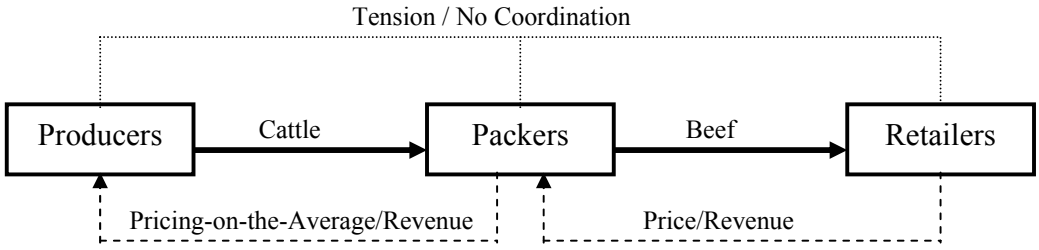


**Figure 4. Beef Supply Chain With and Without Strategic Alliances**

***a. Without Alliances***




** Little information flow/sharing*

***b. With Alliances***

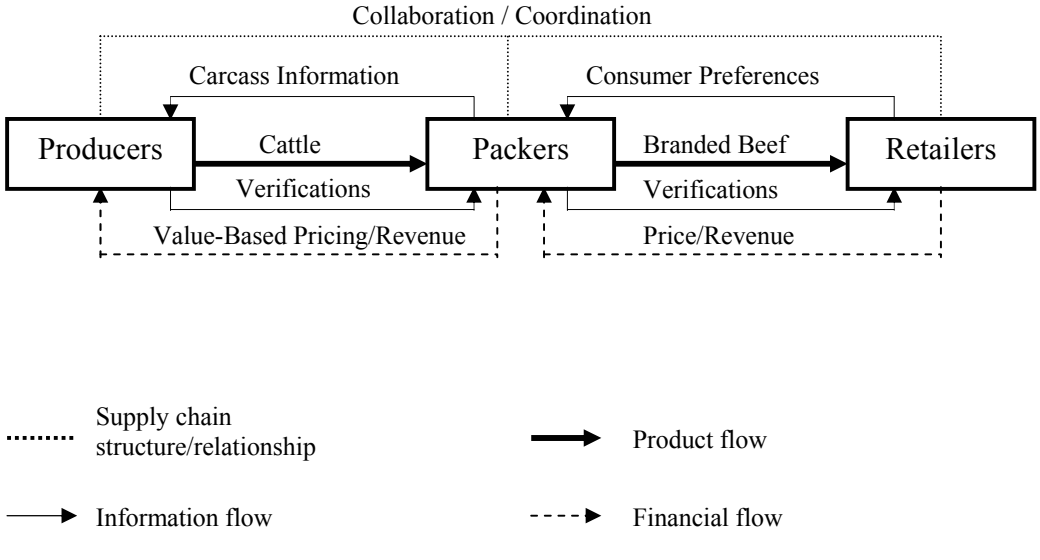


**Table 1. Beef Strategic Alliance Practices**

| Supply Chain Element | Features |
|---|---|
| *Supply Chain Structure* | ● Most alliances encompass three or four stages of supply chain.<br>● Producers could join one or more alliances. |
| *Product Flow* | ● Most alliances impose specific herd management practices and genetics requirements.<br>● Members have delivery obligation.<br>● Most alliances target branded products. |
| *Financial Flow* | ● Most alliances offer a grid pricing method.<br>● Not all alliances offer free membership fee.<br>● Most producers have price premiums. |
| *Information Flow* | ● Most alliances require source verifications and apply EID technology.<br>● Producers apply carcass information to improve herd management and genetic selection. |

**Table 2. Future Development of the Beef Supply Chain**

| Element | Challenges | Suggestions |
|---|---|---|
| *Supply Chain Structure* | ● Need to develop trust and partnership between segments | ● Establish ground rules<br>● Conduct market survey<br>● Develop trust and enhance partnership |
| *Product Flow* | ● Need to improve beef quality and safety<br>● Need to deliver promised volume | ● Conduct market survey<br>● Establish and implement HACCP system<br>● Apply information technology to improve herd management<br>● Apply push-pull strategy to balance supply with market demand |
| *Financial Flow* | ● Need to reduce the financial risks of low beef price at producer side.<br>● Need to reduce physical costs | ● Set up operation standards and apply risk management in herd sorting.<br>● Establish criteria to examine the rationality of price structure<br>● Apply total cost management |
| *Information Flow* | ● Need to ensure information transparency<br>● Need to use information technology more effectively | ● Apply EID and barcode technology<br>● Develop an integrated information system |