Supply Chain Options for Biobased Businesses

Rhonda R. Lummus

Iowa State University, rlummus@iastate.edu

Follow this and additional works at: http://lib.dr.iastate.edu/leopold_pubspapers

Part of the Agribusiness Commons, Biotechnology Commons, Oil, Gas, and Energy Commons, and the Operations and Supply Chain Management Commons

Recommended Citation

http://lib.dr.iastate.edu/leopold_pubspapers/144

This Report is brought to you for free and open access by the Leopold Center for Sustainable Agriculture at Iowa State University Digital Repository. It has been accepted for inclusion in Leopold Center Pubs and Papers by an authorized administrator of Iowa State University Digital Repository. For more information, please contact digirep@iastate.edu.
Supply Chain Options for Biobased Businesses

Abstract
This paper investigates supply chain business relationships that would be appropriate for biobased businesses. It is a final report from the Leopold Center Marketing Initiative project M13-2004.

Keywords
Supply networks, Bioeconomy and energy, Biobased Businesses

Disciplines
Agribusiness | Biotechnology | Oil, Gas, and Energy | Operations and Supply Chain Management

This report is available at Iowa State University Digital Repository: http://lib.dr.iastate.edu/leopold_pubspapers/144
A final report prepared for the Leopold Center for Sustainable Agriculture

09/27/04

Supply Chain Options for Biobased Businesses

Principal Investigator: Rhonda R. Lummus
Associate Professor of Operations and Supply Chain Management
Iowa State University
College of Business
2340 Gerdin Business Building
Ames, IA  50011-1350
(515) 294-2275
Fax (515) 294-2534
rlummus@iastate.edu

Leopold Center’s Marketing and Food Systems Initiative project #: M13-2004
Project time frame: 2 years.
For more information contact:
Rich Pirog, Marketing and Food Systems Program Leader  (rpirog@iastate.edu)
Table of Contents

NONTECHNICAL SUMMARY ......................................................................................................................... 4
ABSTRACT .................................................................................................................................................. 6
INTRODUCTION ......................................................................................................................................... 6
ESTIMATES OF POTENTIAL FARM LEVEL BENEFITS FROM BIOBASED CLUSTERS ......................... 12
BACKGROUND ON SUPPLY CHAIN MANAGEMENT ................................................................................. 14
BEST PRACTICES IN SUPPLY CHAIN MANAGEMENT ............................................................................. 18
BUYER-SELLER RELATIONSHIPS ........................................................................................................... 22
AGRICULTURE AND SUPPLY CHAIN MANAGEMENT ........................................................................... 30
AGRICULTURE RELATIONSHIPS ............................................................................................................. 35
  SPOT MARKET TRANSACTIONS................................................................................................................. 35
  CONTRACTS ............................................................................................................................................... 35
  COST-PLUS AGREEMENTS ....................................................................................................................... 41
  FAIR TRADE ............................................................................................................................................... 43
  QUASI VERTICAL INTEGRATION, TAPERED VERTICAL INTEGRATION/FRANCHISE ......................... 44
  THE VALUE-ADDED AGRICULTURE MODEL/JOINT VENTURES ....................................................... 45
  STRATEGIC ALLIANCES ......................................................................................................................... 46
  THE ROLE OF COOPERATIVES ............................................................................................................... 48
AGRICULTURAL BUSINESS STRUCTURES .............................................................................................. 51
CONCLUSIONS ........................................................................................................................................... 60
REFERENCES: ................................................................................................................................................ 62
BUDGET REPORT ........................................................................................................................................ 3
Nontechnical Summary

The purpose of this paper is to investigate supply chain business relationships that would be most appropriate for biobased businesses. A framework is required that identifies the business structures available to farmers producing products to serve the new bioindustries which translate into wealth creation for farmers. The manner in which biobased businesses are developed will have tremendous implications for the future wealth of Iowa’s farmers, communities and the economic condition of the state. While there may be great opportunities for large scale farms using best practice management standards to succeed in the new bioeconomy, it is more difficult to envision the role of the mid-sized farmer. How should these farmers look to improve their profitability as they begin providing products to biobased processing companies?

An initial literature review provided background on supply chain practices and identified best practices in supply chain management. A discussion of existing agricultural business supply chain practices was included. Finally, a complete discussion of possible business structures was developed along with an analysis of benefits and disadvantages for all links in the supply chain. While none of the models provides the perfect solution for farmers, the benefits of strategic alliances that are long term and based on trust between partners appear to have the most potential for new biobased businesses.

With strategic alliances both parties share the risks and benefits and both make decisions. These relationships are often flexible and trust-based and both parties work towards a mutual goal. Both groups use their complementary assets to gain long-term competitive advantage for the supply chain. The relationships often are very broad and difficult to define by contract and generally need to be built over time. Strategic alliances also allow for product differentiation, improved traceability and quality specifications. Since these relationships are trust-based both the
farmer and the processor must be committed to making them work. There is generally no penalty for one or the other defecting from the agreement. The relationships generally require systems for sharing information; and some of the detailed information required, such as product or processing costs, may be difficult for either side to disclose. Also, there must be a group of committed growers to make an alliance feasible, and then they are likely to give up some independence.
Supply Chain Options for Biobased Businesses

Abstract

The purpose of this report is to investigate and evaluate existing supply chain structures currently being used in biobased businesses, and corollary examples of supply chains in businesses of all types (U.S. and abroad). In addition it will identify key characteristics of each structure, and analyze the benefits and disadvantages for each type of structure.

Introduction

Economic development and growth in the 20th Century was driven by the industrialization of crude oil, coal, and natural gas as raw materials for chemicals, fuels, materials, and energy. Sustainable economic development for the 21st Century dictates that biorenewable resources provide a new foundation for these sectors of the economy. The rise of biorenewables, like the rise of oil a century ago, will offer rich rewards for those with the knowledge, creativity and technical innovation needed to turn vision into reality.

The U.S. Department of Agriculture (USDA, 2004) defines biorenewable resources, or biomass, as any organic matter that is available on a renewable or recurring basis, excluding old-growth timber and including dedicated energy crops and trees, agricultural food and feed crop residues, aquatic plants, wood and wood residues, animal wastes, and other waste materials. Waste materials include biological wastes, predominantly from corn, and can include paper mill, wood, and municipal solid wastes. They further define the term "biobased product" as any commercial or industrial product (other than food or feed) that utilizes biological products or renewable domestic agricultural (plant, animal, or marine) or forestry materials. Examples of bioproducts derived from animals include: adhesives, personal care products, nutraceuticals and pharmaceuticals from cattle and swine as well as heat, light, electricity, fuels, and fertilizer from animal waste. Examples of bioproducts derived from plants include: ethanol, plastics, cleaning solvents, and road de-icer from corn; packaging films, paper whitener, and water repellent coating
from wheat; dyes, specialty chemicals, and lubricants from kenaf; and coatings, adhesives and biodiesel from soybeans.

Examples of firms and the products they produce can be found in The Journal of Industrial Ecology (2004). They describe four examples of biobased companies. 1. California Agriboard, LLC (CalAg) a private California corporation which will begin producing a new medium-density fiberboard in Willows, California in 2005. CalAg will utilize rice straw as the feedstock for producing the fiberboard. 2. In 2002 Cargill Dow LLC, based in Minnesota, began large-scale production of a proprietary polylactide polymer, NatureWorks PLA, from field corn. The facility, which represents nearly $750 million in investments, is capable of producing more than 300 million pounds (about 136 million kilograms) of NatureWorks PLA per year and using up to 40,000 bushels (about 1.4 million liters) of corn per day. The resin is being shipped around the globe for use in producing food and nonfood packaging, disposable cups and utensils, comforters, pillows, carpet tiles, and apparel. 3. KP Products Inc., known as Vision Paper, in 1991 became the first company in the world to produce paper made from 100 percent kenaf and processed without the use of chlorine bleaching chemicals. The company produces high-quality paper at a competitive price. 4. GEMTEK Products, first established in 1991, manufactures a broad range of biobased chemicals including cleaners, solvents, lubricants, personal care products, specialty products such as anti-allergen solutions, and alternative fuels. All of its products are produced from seed oils, related alcohols, and other materials from soy, corn, canola, peanut, palm, linseed, cottonseed, sunflower, jojoba, and others.

Another example of a company investing in biobased products is Herman Miller, a $1.34 billion office furniture company, which has incorporated several biobased items into a new line of products (Herman Miller, 2004). Kira is a proprietary panel system fabric made from 100 percent annually renewable biobased fiber derived from the plant sugars of corn. Kira contains no
petroleum, yet it functions in the same applications as polyester synthetic fibers. It is suitable for a variety of textile products and applications, and can be completely composted at the end of its useful life. Wheat Board Core is a low-emission, rapidly renewable material composed primarily of wheat straw fibers. Herman Miller offers it as a standard option horizontal work surface on panel-based systems. Developed by Dow BioProducts Ltd., of Canada, Wheat Board Core is similar in appearance to particleboard and medium-density fiberboard, but it is made using a high-performance formaldehyde-free polyurethane resin. In addition to its rapidly renewable and low-emission qualities, Wheat Board Core is moisture-resistant and comparable in weight to standard particleboard.

Genencor (2004) is a diversified biotechnology company with over $380 million in 2003 revenues. In 2000, Genencor began working on a process to develop low-cost celluloses and other enzymes for the production of ethanol from biomass rather than from corn kernels. Genencor is working on a system to break down cellulosic material (plant matter) and other complex carbohydrates into fermentable sugars. These sugars are the raw materials refined into ethanol, organic chemicals and other bioproducts like plastics.

Other companies are investigating new biobased products (see U.S. Department of Energy, 2003). Dow Chemical has joined with Universal Textile, a carpet backing supplier, to launch the BIOBALANCE™ polymers line, a soy-based product that can replace a portion of the polyurethane carpet backing that is now the standard in carpet manufacture. This product also can be used in automotive interiors and other textile applications. Procter & Gamble, a major producer of household products, has formed a “technology council” with Archer Daniels Midland (ADM) to develop new natural products that take advantage of P&G marketing strengths and ADMs biobased raw materials. P&G also is working with the USDA to develop a process for producing lauric oil from cuphea, an oilseed that grows in the U.S., rather than from expensive imported tropical oils.
To foster the development of biobased businesses, it has been suggested that developing a system of biorefineries (multiple, synergistic bioprocessing businesses) could be the foundation for the new businesses. At the same time, these biorefineries would create significant opportunities for agriculture. The biorefinery is similar in concept to the petroleum refinery, except that it is based on conversion of biomass feedstocks rather than crude oil. Biorefineries would use multiple forms of biomass to produce a flexible mix of products, including fuels, power, heat, chemicals and materials. Additional information on biobased businesses and products can be found at the Biobased Manufacturers Association (2004) web site.

SustainableBusiness.com (2004) describes activities the federal government has engaged in to support early market growth in demand for bioenergy and biobased products. Congress enacted the Biomass Research and Development Act of 2000, to bring new focus to public sector involvement in the conversion of biomass into biobased industrial products, including bioenergy. The legislation called for increased coordination across federal government departments and agencies associated with biomass research and development (R&D); and the USDA and the Department of Energy (DOE) were designated as the lead departments in that effort. The 2002 farm bill created a program for preferred procurement of biobased products (not including motor fuels and electricity) under which federal agencies must buy biobased products. The federal government also supports ethanol demand by providing a reduction in federal gas tax for each gallon of gasoline with a 10 percent ethanol blend.

While there is much interest and support for biobased businesses, the development of these businesses requires advances in science and technology, evaluation of agricultural practices and resolution of supply chain issues. The issue of supply chain development for biorefineries is discussed in both the national and Iowa vision and roadmap documents for biobased products and bioenergy. The national vision and roadmap document highlights the need for research and
development for “addressing the facilities, location, handling and delivery issues for a plant-based feedstock supply chain, including mechanisms to enhance the economy of rural regions” (see U.S. Department of Energy, 1998). The newly released Iowa vision and roadmap (Iowa State University Extension, 2002) likewise lists two specific needs related to supply chain development:

1. Research and demonstration programs to assist (model) new business arrangements between agricultural producers (coops and alliances) that provide necessary quantities for biomass for biorefineries;
2. Research and demonstration of creative business relationships between links of biobased supply chains.

Clearly, the manner in which the biorefineries are developed will have tremendous implications for the future wealth of Iowa’s farmers and communities and for the economic condition of the state. While there may be great opportunities for large-scale farms using best practice management standards to succeed in the new bioeconomy, it is more difficult to envision the role of the mid-sized farmer. Should these farmers plan to get ahead by moving up the value-added ladder and gaining some of the profits from further processing their raw materials into semi-finished products? Many in the industry believe this is the model to follow. In the last few years, a number of farmer-owned manufacturing facilities have been established, particularly in the bioenergy area.

Another view that has gained favor is that of developing “biocenters” close to the source of biomass supply (in rural areas). The biocenters will process particular inputs into semi-finished products which then move to another nearby location for further processing. These biocenters would result in jobs, income, and an improved tax base for rural communities. While most would agree that these new businesses would be an asset to the state of Iowa, no one is quite sure of the impact on farmer income and wealth creation. As Morris notes (2000), other agricultural products, such as corn, have seen increased productivity without corresponding increased revenue to farmers. Concentration in the retail and food processing industries has driven requirements for
lower costs. Morris suggests that in the new bioeconomy, it is imperative that farmers be rewarded for their output.

A framework is required that identifies the business structures available to farmers who are producing products to serve the new bioindustries which translate into wealth creation for farmers. This paper is designed to identify those structures. The paper will begin with an initial literature search which describes potential benefits from biobased businesses. Next, it will provide background on the development of supply chain practices and identify best practices in supply chain management and in buyer/seller relationships. Third, it will investigate non-biobased agricultural business supply chain practices and discuss their current use. Finally, a complete discussion of each business structure will be provided to evaluate the effectiveness for farmers.

The discussion will include:

- description of specific business model,
- description of supply chain partners,
- analysis of benefits (for all links for the supply chain and for the community where the business resides), and
- analysis of disadvantages (for all links of the supply chain and for the community).

The need to study business structures and relationships within agriculture has been recognized for some time. Rausser et al. (1987) noted that studies of contractual arrangements and organizational structures are needed in food marketing systems. They believed future research should focus on relationships between contract organizational forms, agricultural policy programs and social institutions. Figure 1 describes a typical international agriculture supply chain.
Figure 1: Typical Agricultural Supply Chain
Estimates of Potential Farm Level Benefits from Biobased Clusters

The importance of biobased business has been emphasized earlier by government entities encouraging a move from a petroleum-based society. The potential overall market size of biobased business is difficult to identity. A study by Agriculture and Agri-Food Canada (Crawford, 2001) of biobased markets estimated the potential market size by 2005 for five clusters of businesses (see Table 1). The estimates were based on studies of U.S. market trends and interviews with industry and government representatives in Canada. Among the more interesting data were their estimates of the calculated net benefit to farmers, using the average raw material prices typically paid by industries operating within each market cluster. The total projected sales in 2005 were $2.68 billion. The total net value to farmers was projected to be $421 million per year by 2005 or about 16 percent. The study indicates biobased businesses will have a significant impact on the economy and can provide an increase in revenue for farmers. A major challenged noted in the report was the commercialization of innovations within biobased products.

An interesting supply chain consideration as the economy shifts from petroleum-based to biobased is that the location of processors and the jobs to support them in the supply chain will shift (Armstrong, 2003). The economics of biobased materials will not support transporting them much farther than 250 to 300 miles from their growing location. Biorefineries will have to be built close to where the product is grown. Regionalized agriculture is likely to result, with certain products being grown close to processors. This likely will create non-farming jobs in rural areas.
<table>
<thead>
<tr>
<th>Industrial Market Cluster</th>
<th>Industries</th>
<th>Potential Market Size ($millions)</th>
<th>Farmer Benefit (%)</th>
<th>Farmer Value ($millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemical</td>
<td>- resins, plastics, paints, coatings, soaps, cleaning compounds, toiletries, fragrances, cosmetics, lubricants, greases</td>
<td>1690</td>
<td>10</td>
<td>170</td>
</tr>
<tr>
<td>Biomass fibres</td>
<td>- fibre products like strawboards</td>
<td>570</td>
<td>35</td>
<td>200</td>
</tr>
<tr>
<td>Health</td>
<td>- nutraceuticals, essential oils, pharmaceuticals, drugs and medicines</td>
<td>260</td>
<td>8</td>
<td>21</td>
</tr>
<tr>
<td>Energy</td>
<td>- ethanol, biodiesel, electricity, fuel additives, lubricants and greases</td>
<td>110</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>Environment</td>
<td>- bioremediation, phytoremediation, biocontrols</td>
<td>50</td>
<td>25</td>
<td>12.5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2680</td>
<td>16%</td>
<td>421</td>
</tr>
</tbody>
</table>

Background on Supply Chain Management

Supply chain management is a concept that has emerged since the early 1990s as companies realized they could no longer compete independently, but required the cooperation of their supplier and customer partners. Porter's work on value chains and value systems captures the essence of organizing activities within and between firms in order to transmit value to the ultimate customer (Porter, 1985). Ellram and Cooper (1993) defined supply chain management as “an integrating philosophy to manage the total flow of a distribution channel from supplier to ultimate customer.” Monczka and Morgan (1997) state that “integrated supply chain management is about going from the external customer and then managing all the processes that are needed to provide the customer with value in a horizontal way.” They believe that supply chains, not firms, compete and the strongest competitors are those that “can provide management and leadership to the fully integrated supply chain including external customer as well as prime suppliers, their suppliers, and their suppliers’ suppliers.” A key point in supply chain management is that the entire process must be viewed as one system. Any inefficiencies incurred across the supply chain (which includes suppliers, manufacturing plants, warehouses, customers, etc.) must be assessed to determine the true capabilities of the process.

Why has managing the supply chain become an issue? In part, this is because few companies continue to be vertically integrated. Companies have become more specialized and search for suppliers who can provide low-cost, quality materials rather than cultivate their own source of supply. It becomes critical for companies to manage the entire supply network to optimize overall performance. These organizations have realized that whenever a company deals with another company that performs the next phase of the supply chain, both stand to benefit from the other's success.
A second reason partially stems from increased national and international competition. Customers have multiple sources from which to choose to satisfy demand; locating product throughout the distribution channel for maximum customer accessibility at a minimum cost becomes crucial. Previously, companies looked at solving the distribution problem by maintaining inventory at various locations throughout the chain. However, the dynamic nature of the marketplace makes holding inventory a risky and potentially unprofitable business practice. Customers’ buying habits are constantly changing, and competitors are continually adding and deleting products. Changes in demand make it highly likely that the company will have the wrong inventory. The cost of holding any inventory also means most companies cannot provide a low-cost product when funds are tied up in inventory.

A third reason for the shift in emphasis to the supply chain is because most companies realize that maximizing performance of one department or function may lead to less than optimal performance for the whole company. Purchasing may negotiate to lower the price on a component and receive a favorable purchase price variance, but the cost to produce the finished product may rise due to inefficiencies in the plant. Companies must look across the entire supply chain to gauge the impact of decisions in any one area.

Advanced Manufacturing Research, a Boston-based consulting firm, developed a supply-chain model which emphasizes material and information flow between manufacturers and their trading partners (Davis, 1995). They believe the changes required by management are due to the following changes in how manufacturers are doing business:

- Greater sharing of information between vendors and customers,
- Horizontal business processes replacing vertical departmental functions,
- Shift from mass production to customized products,
- Increased reliance on purchased materials and outside processing with a simultaneous reduction in the number of suppliers,
- Greater emphasis on organizational and process flexibility,
- Necessity to coordinate processes across many sites,
• Employee empowerment and the need for ‘rules-based’ real time decision support systems, and
• Competitive pressure to introduce new products more quickly.

Companies are streamlining all operations and minimizing the time-to-customer for their products.

The history of supply chain management began with work in both the textile and grocery industry supply chains. Due to intense competition in the textile and apparel industry world-wide, leaders in the U.S. apparel industry formed the Crafted With Pride in the U.S.A. Council in 1984 (Kurt Salmon Associates, Inc, 1993). In 1985, Kurt Salmon and Associates were commissioned to conduct a supply chain analysis. The results of the study showed the delivery time for the apparel supply chain, from raw material to consumer, was 66 weeks long, 40 weeks of which were spent in warehouses or in transit. The long supply chain resulted in major losses to the industry due to financing the inventory and the failure to have the right product in the right place at the right time.

The result of this study was the development of the Quick Response (QR) strategy. QR is a partnership where retailers and suppliers work together to respond more quickly to consumer needs by sharing information. Significant changes as a result of the study were the industry adoption of the UPC code used by the grocery industry and a set of standards for electronic data interchange (EDI) between companies. Retailers began installing Point of Sale (POS) scanning systems to transfer sales information rapidly to distributors and manufacturers. Quick Response incorporates marketing information on promotion, discounts, and forecasts into the manufacturing and distribution plan.

In 1992, a group of grocery industry leaders created a joint industry task force called the Efficient Consumer Response (ECR) Working Group. The group was charged with examining the grocery supply chain to identify opportunities to make the supply chain more competitive (Kurt Salmon Associates, Inc, 1993). Kurt Salmon Associates were engaged by the group to examine
the grocery supplier/distributor/consumer value-chain and determine what improvements in cost and service could be accomplished through changes in technology and business practices.

The results of the study indicated little change in technology was required to improve performance. However, the study identified a set of Best Practices which, if implemented, could substantially improve overall performance of the supply chain. As Kurt Salmon and Associates (1993) found, "By expediting the quick and accurate flow of information up the supply chain, ECR enables distributors and suppliers to anticipate future demand far more accurately than the current system allows." Through implementation of Best Practices they projected an overall reduction in supply chain inventory of 37 percent, and overall cost reductions in the industry in the range of $24 to $30 billion.
**Best Practices in Supply Chain Management**

A discussion of biobased business supply chains should include a review of best practices in current supply chains. In their article on “New Business Models for Supply Chain Excellence,” Mulani and Lee (2002) describe many of the issues facing supply chains today and provide examples of well-run supply chains. Dell Computer is often cited as one of the more successful supply chain examples. Dell uses a consumer-direct approach based on build-to-order manufacturing, effective supplier management to shorten component lead times, eliminating inventory through just-in-time processes, and using technology to integrate tightly with customers and suppliers. Cornerstones of Dell’s strategy are: sell what you have and use day-to-day pricing and incentives to shift demand; minimize stock - their average inventory is less than four days; ensure quick product life cycle transitions; leverage immediate customer feedback and market insights; and control pricing every day. Dell has linked its supply chain directly to corporate customer processes and operations via custom-tailored account pages for each customer and various other customer services. This allows Dell to build knowledge of the customer, be more sensitive to changes in customer processes and technology, and solidify barriers to entry by competitors.

Scholastic, the world’s leading publisher and distributor of children’s books, is a good example of a company that uses the right channel strategy to create barriers to entry for supply chain competitors (Mulani and Lee, 2002). Its direct-to-classroom book club business treats each teacher as an individual customer; coordinates several offers and products simultaneously; accommodates tight order-fulfillment time frames along with periodic spikes in demand and multiple SKUs; and enhances school-channel loyalty with syllabus support materials, credits for
free books, and classroom technology support. Scholastic uses their supply chain channel strategy to improve its competitiveness.

Other company examples of specific areas of supply chain success are provided by Hildebrand (1998). Bergen Brunswig Corporation, a pharmaceutical and medical supply distributor, signs performance-based contracts with customers and shares supply chain cost reductions over 10 percent with their customers. McKesson Corporation, a pharmaceuticals and medical supplies distributor, provides skills and funding for supply chain partners to gain the right technology. After implementation, both McKesson and the partner take advantage of cost savings. Their philosophy is “a partner that has been helped rather than left on its own is one that may eventually return the favor.” Dana Corporation, an automotive parts manufacturer of chassis for Ford, Chrysler and others, extends the supply chain into product design. They provide input on how to save money on parts while their customers’ vehicles are still on paper and ask their suppliers for the same input. Home Depot, a retailer of home improvement products with 1278 stores in the United States, helps suppliers get manufacturing loans. Home Depot realizes that if banks know that Home Depot is behind a company and wants to buy their product, it will likely help get the investment. At the same time, Home Depot wins a loyal supplier. What all of these companies recognize is that their supply chain is only as strong as its weakest link and they work with their partners to improve performance.

A general summary of supply chain “best practices for successful supply chains” would include:

- Reducing the number of suppliers,
- Emphasizing total acquisition cost,
- Focusing on relationship management,
- Practicing global sourcing, and
- Making product decisions based on purchase price, lead-time, technology, flexibility to respond to change, economic and political stability.
A focus on relationship management includes regularly sharing information on plans, customer needs, capacity, and supply chain costs. Partners are selected on the basis of mutual interest and values. A portfolio of partnering strategies is used where a one-time small dollar value purchase would not suggest that a partnership would be appropriate. Traditional, open-market, negotiated interactions may make the most sense with commodity-type products. Practicing global sourcing includes looking at the best source of product to supply global operations and requires managing a complex array of networks and alliances. With global purchasing, landed cost and access to high-quality materials and technology are the factors that drive purchases.

Many of the improvements in supply chain performance would not have been possible without similar improvements in the technology information systems that are the backbone of most well-run supply chains. Companies today use the World Wide Web and the Internet to exchange information between supply chain partners and with end customers. The wide-spread usage of Enterprise Resource Planning (ERP) systems has allowed companies to track inventory and scheduling plans internally and then share that information with supply chain partners. In addition, new technology innovations are changing the way supply chains perform. For example, e-auctions allow companies to list products for sale via the Internet and auction them to the highest bidder. Best candidates are commodity products (i.e., price-driven products), though companies are beginning to use e-auctioning for more strategic materials. Private exchanges electronically synchronize a firm’s supply chain with those of its strategic trading partners to buy, sell, and move goods more efficiently. Product design collaboration using decision support systems manages design across the lifecycle of a product, from introduction to service support to obsolescence, by having suppliers become part of the design process. This helps cut design and production times, improves product quality, and achieves faster time-to-market.
The use of the Internet for direct sales to end customers has changed the structure of many supply chains, eliminating or supplementing middlemen such as wholesalers and retailers. Customers expect information about what is and is not in stock, ordering systems that are available 24 hours a day, and the ability to customize product requirements. Companies have been required to implement the on-line capabilities for customers to place orders but also have been forced to add new back office information systems to validate customer requested ship dates and make shipments to end customers in quantities as small as one item.

These best practices for supply chains are important benchmarks for new agricultural biobased businesses to consider. Many of the biobased supply chains will be competing with existing, highly efficient supply chains with years of process improvement history. To be successful, the new businesses must begin with many of these best practices as part of their supply chain structure.
**Buyer-Seller Relationships**

As part of understanding biobased business structures, it is important to understand the interactions between buyers and sellers. Relationships between buyers and sellers have long been studied in the purchasing, operations, and marketing literature. A good framework for the development of buyer-seller relationships as outlined in marketing theory can be found in Dwyer, Schurr and Oh (1987). Their summary describes two distinct types of transactions. Discrete transactions are those with little communication, short duration, and it matters little who fills the requirement. An example would be a spot purchase of unbranded gasoline out-of-town at an independent station. Relationship transactions result from increased dependence and possibly from legal obligations. Examples include long-term associations (loyalty programs such as frequent flier programs, book or record clubs, season tickets for sports), contractual relations, and other collaboration efforts. The authors describe the analogy of the interpersonal and interdependent relationship between husbands and wives as a good framework for describing the evolution of buyer-seller relations. They also discuss the importance of switching costs in situations. If the buyer incurs high switching costs, due to the technology or use of the product, they have a significant interest in maintaining a quality relationship. Costs of maintaining a relationship may be high for both partners and the relationship needs to be advantageous to both.

Further marketing research by Noordewier, John and Nevin (1990) describes the various characteristics that move a relationship from a discrete transaction to a genuine relationship. The necessity for the supplier to be *flexible* (in terms of adjustments to price, inventory, quick deliveries, product changes, etc.) moves it closer to a relationship rather than a discrete, one-time purchase of a given item of fixed design and price. Relationships increase as the supplier provides more *assistance* to the seller, i.e. with product design, advance shipment notice, or notification of
product problems or delays. When buyers require significant information from the seller such as product specifications, delivery schedules, long-term forecasts, and planning schedules, the transaction moves from discrete to more relational. Situations where the buyer must supervise or monitor the supplier’s actions to ensure specific behavior increase the relationship aspect of the transaction. The last situation that affects the relationship is the expectation of future exchange between the two parties. The relationship grows as the parties expect to do business over a longer period of time and often without a termination date.

The operations literature describes the techniques used by the Japanese in the early 1980s to collaborate successfully with suppliers which led to gains in manufacturing competitiveness in a variety of industries. The Japanese developed a supplier association, known as Kyoryoku Kai to improve relationships with suppliers (Rich and Hines, 1997). A supplier association was defined as “a mutually benefiting group of a company’s most important subcontractors, brought together on a regular basis for the purpose of coordination and cooperation as well as to assist all the members to benefit from the type of development associated with large Japanese assemblers: such as kaizen, just-in-time, kanban, U-cell production and the achievement of zero defects.” These associations that served to coordinate the entire subcontracting system were used as a forum to discuss corporate strategy, and also to share engineering and cost information. This strategy of developing collaborative relationships recognized the dependency of the organizations on the supplier network and focused on the socialization process rather than the formal contract between the organizations. The system of subcontracting and building long-term relationships with suppliers has been very successful in Japan. One of the backbones of these relationships is that cost reductions and quality improvements are made by the companies working together. Suppliers remain highly competitive, but under partnership arrangements cost reductions are achieved through cooperation. Bargaining is based not on price alone, but rather on a target price, while
maintaining a reasonable level of profit for the supplier. These relationships focus on mutual benefit.

Some authors believe that this success is only due to the nature of Japanese business relationships. Rather, they contend that buyer-seller relationships are really driven by the power maintained by one or the other organization in the relationships (Cox, 2001). Rather than viewing business relationships from an integrated supply chain perspective, Cox notes that businesses inherently are looking for the best return and as a result will wield whatever power is possible over their suppliers to ensure low costs or keep their competitors at a disadvantage. He defines one of four positions in which the buyer may reside. When the buyer is dominant, he can leverage the supplier’s quality or cost and ensure that the supplier receives only average returns. When the supplier is dominant, the buyer will be limited by both the price and availability of the supplier’s offering. In the situation when neither has leverage over the other, the supplier must take the current prevailing price, which may or may not be an advantage for the buyer. When the two are interdependent, neither party can force the other to do anything; as a result the two parties must work together closely. The supplier receives good returns but must pass on some of the value to the buyer.

Cox argues that companies must understand where they are in the power structure and find ways to move to a more favorable position of power in the relationship. It is his perception that the dominant position would be more favorable than any other given the nature of the competitive business environment. There certainly is support for Cox’s view on power in relationships and its effect on supply chain partners. As Stine notes (2003), the large grocery retailers led by Wal-Mart are driving down prices for the products purchased from their suppliers. The supplier companies such as General Mills or ConAgra that feel the price pressure will in turn apply pressure to
farmers. Rather than raise prices, Wal-Mart expects suppliers to cut the cost of producing their products to increase profits.

More recent studies on relationships between buyers and sellers have focused on the attributes that are important in business-to-business relationships. Rhinehart, et al., (2004) identified seven basic relationship types based on the attributes of trust in the other party, interaction frequency, and the commitment to the relationship. These relationship types include: alliances, administered relationships, contractual relationships, non-strategic transactions, joint ventures, specialty contract relationships and partnerships. Non-strategic transactions are based on an arms-length approach and on the economic capability of each party. Administered relationships may include one-time or multiple transactions and the relationships are managed through a non-formal strategy (i.e., supplier development programs). Contractual relationships are used when more formal control of the business is required. A high volume of business may be conducted, yet neither party is willing to invest in the other’s business. Specialty contracts are used for unique products or services where there may be few buyers or sellers.

Rhinehart et al. (2004) continues by defining a partnership classification which is less formal than contracts, and no written agreements or legal documents are created. As such, there are more uncertainties between the parties and this can result in differences of opinion on performance. Joint ventures usually are completed through some form of financial investment by both parties with the goal of achieving mutual benefits. Joint ventures actually may be the result of a lower level of trust where the firms use financial investment to ensure performance. The final type of relationship is an alliance which involves some form of investment to achieve joint benefits. Alliances differ from joint ventures in that there is a greater degree of trust in the relationship and yet some degree of perceived dependence on the other party.
The advantages to partnering with a supplier from the buyer’s perspective include (Ellram, 1995): 1.) ease of managing a smaller supply base, 2.) less time searching for new suppliers, 3.) mutual dependence results in stability and greater loyalty, 4.) more stable prices, 5.) joint planning and information sharing based on mutual trust, and 6.) better quality. Rudzki (2004) notes that partnering is not an easy process. As a practitioner, his company formed a strategic partnership with a supplier which evolved over 12 months of discussions and negotiations. “We explored strategic, cultural and operational aspects. We thrashed out relative competencies, risk sharing, and shared investment. And, of course we wrestled over price and delivery” (Rudzki, 2004 p. 51). He notes that businesses can no longer afford not to partner, but at the same time they cannot afford to partner poorly.

A summary of the differences in relationships between traditional buyer-seller markets and supply chain partnerships can be found in Table 2 (Fearne and Duffy, 2003).
Table 2: Key extremes of buyer-supplier relationships

<table>
<thead>
<tr>
<th>Traditional Arms-length Relationships</th>
<th>Supply Chain Partnerships</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term focus on individual transactions</td>
<td>Commitment to long-term relationships</td>
</tr>
<tr>
<td>Buying decision made on price</td>
<td>Buying decision made on value</td>
</tr>
<tr>
<td>Many suppliers</td>
<td>Fewer selected suppliers</td>
</tr>
<tr>
<td>Low interdependence</td>
<td>High interdependence</td>
</tr>
<tr>
<td>Haphazard production and supply scheduling</td>
<td>Order driven production and supply</td>
</tr>
<tr>
<td>Limited communication restricted between sales and purchasing</td>
<td>Open communication facilitated by multilevel/ multifunctional relationships</td>
</tr>
<tr>
<td>Little co-ordination of work processes</td>
<td>Integration / co-ordination of work processes</td>
</tr>
<tr>
<td>Relationship specific investments avoided</td>
<td>Increases in relationship specific investments</td>
</tr>
<tr>
<td>Information is proprietary</td>
<td>Information is shared</td>
</tr>
<tr>
<td>Clear delineation of business boundaries</td>
<td>Creation of inter-company teams</td>
</tr>
<tr>
<td>Use of threats to resolve disputes.</td>
<td>Joint problem solving approach to conflicts</td>
</tr>
<tr>
<td>Unilateral improvement initiatives</td>
<td>Continuous joint improvement sought</td>
</tr>
<tr>
<td>Separate activities</td>
<td>Engage in joint activities</td>
</tr>
<tr>
<td>Dictation of terms by more powerful firm</td>
<td>Joint decision making</td>
</tr>
<tr>
<td>Adversarial attitudes/combat</td>
<td>Cooperative attitudes/ teamwork</td>
</tr>
<tr>
<td>Conflicting goals</td>
<td>Compatible goals</td>
</tr>
<tr>
<td>Behave opportunistically</td>
<td>Mutual trust exists</td>
</tr>
<tr>
<td>Act only in own interest</td>
<td>Act for mutual benefit</td>
</tr>
<tr>
<td>Win-lose orientation</td>
<td>Win-win orientation</td>
</tr>
</tbody>
</table>


Some potential benefits of supplier-customer alignment have been provided by Kashani (2004). He separates the benefits into those benefiting the customer and those benefiting the supplier.

Figure 2 describes those benefits that result in the production and supply chain processes within the companies. Other processes, such as the new product development process, also would realize benefits from closer supplier-customer alignment. Achieving alignment with customers is not an easy process. Kashani (2004) describes the process IBM used in the 1990s to become connected with customers. Termed ‘Operation Bear Hug’, it forced the company’s top 50 executives to visit a minimum of five clients each within a year to find out what issues their customers were facing in order to align with their needs.
Figure 2: Supply Chain Benefits from Supplier/Customer Alignment

A succinct summary of the keys to successful development of partnership relationships, specifically in the food industry, is provided by Hughes and Ray (1994). These include:

1. Clear benefits for all partnership and alliance members.
2. Business proposition underpinning the partnership that makes long-term commercial sense.
3. Focus on specific partnerships, products and markets.
4. Build upon successful partnerships.
5. Apply lessons learnt from the partnership to gain benefits in other business areas.
6. Partners/alliance members should have a good strategic fit.
7. The commercial relationship should be based on interdependence.
8. Companies have similar corporate values and the same commercial ethos.
9. Mutual trust and respect.
10. Aim high on quality – make it difficult for others to follow.
11. For junior partners: pick a senior partner with a long-term commercial future
12. Build relationships and communication links among all levels of the two businesses.
13. Gain full endorsement of the venture by the most senior management and strong personal commitment of all staff.
14. Members should hold a common view on the long-term objectives of the partnership.
15. Partnership members should hold a common view of what the final consumer wants.
16. Raise the veil of secrecy and focus on sharing information required to make the partnership a success.
17. Investment in physical plant and, for horizontal partnerships, joint investment by members builds commitment to the venture.
18. Build flexible organizations that meet the specific needs of each partnership.
19. Fix problems as they arise – delays only serve to disrupt.
20. To ensure success, partnerships require their fair share of commercial good fortune.

Partners in these supply chains have a specific interest in seeing their partners succeed. They are not focused on a specific contractual relationship, but have built a relationship based on trust and mutual interdependence. New biobased businesses should consider these relationship issues as they begin working with supply chain partners.
Agriculture and Supply Chain Management

Supply chain management has been discussed in various agricultural industries and should be evaluated by new biobased businesses. In agriculture, the key stages in the supply chain include: basic science, crop production, processing, and product demand. A good discussion of supply chain management and the food industry can be found in Hildred and Pinto (2002). They discuss the current concentration at the retail food level and in food manufacturing or processing.

At the retail level in 1999, the four largest firms hold 43 percent of the market and the top six have more than 50 percent (including Kroger, Wal-Mart, Alberstons, Safeway, Royal Ahold and Del Haize). This concentration also occurs among the large food manufacturing firms with the top six holding more than 50 percent of the market. In animal slaughter and processing the same concentration exists with four firms controlling from 42 to 79 percent of the market across the various commodities. There is every indication that this concentration is continuing across both retailers and food processors.

The same concentration might be said to be occurring in the farm sector where the number of farms continues to fall and more than 90 percent are considered to be small farms selling less than $250,000 per year (Hildred and Pinto, 2002). The largest 2 percent of the farms maintain over 50 percent of sales. However, the 2 percent is still made up of over 400,000 farms which indicates little true concentration. In some areas, such as with cattle production, more of the product is moving to be produced under contract with the processor, as already is the case in both poultry and hog production. As the authors note (p. 5), “Far from a consumer-friendly-competitive structure, the system for delivering food has nodes of significant market power at every stage.”

The implications for these types of systems are that there may be anticompetitive behavior patterns across these supply chain connections.
McCluskey and O’Rourke (2000) discuss relationships between produce suppliers (fresh and frozen fruits and vegetables) and retailers noting the increased consolidation among retail grocers. Their study used an interview process to identify relationship issues between small to medium (sales of $10 to $50 million) fresh and frozen produce suppliers and large retailers in the western United States. The suppliers noted that business relationships are changing. Buyers are focused more on product specifications to pay for the quality received. They also noted downward pressure on prices as a result of power shifting to ever larger accounts. Personal relationships, once the norm with buyers, are falling by the wayside as consolidation increases. The suppliers expect the large retailers to reduce their number of suppliers and most expected some type of web-based information system for transactions be required in the future. They see a need for consolidation along the supply side, as large retailers will be more likely to select large suppliers.

Some retailers noted a preference to maintain a mix of small and medium-sized firms as suppliers although full truckload shipments to distribution centers were preferred (McCluskey and O’Rourke, 2000). Retailers only purchased from pre-qualified suppliers on approved vendor lists. All agreed that product quality and value were most important in choosing and retaining suppliers. Retailers also expect electronic transactions to play a bigger role in the future. Logistical efficiency was of prime importance to retailers and all were looking at improvements in distribution centers to improve response time. Delivery times were specified, with penalties for late delivery. Retailers encourage suppliers to work with them on joint efforts in advertising, promotion, merchandising, and food demonstrations. In summary, the authors recognize the shift in power to retailers and suggest the following recommendations to suppliers (p.19):

1. Better understand how food system demands are changing.
3. Consolidate into larger units.
4. Form alliances with other producers, packers, and processors to achieve critical mass as cost-competitive suppliers.
They believe that requirements of the large retail chains will make it more difficult for small, under-capitalized firms to compete and survive.

In his discussion of supply chains in the European fresh produce market, Zuurbier (1999) evaluated how retail companies managed these supply chains. He also discussed the coordination devices, technology, and institutional arrangements they used. He identified a list of issues for the wholesalers, packers and shippers which made supply chain coordination particularly difficult (p. 23):

1. Perishability (loss of quality after harvest)
2. Guarantee of year-round supply (due to distances and lack of speed)
3. High logistics costs (the costs of physical distribution, packaging at the point of harvest, repackaging at the point of shipment, at the distribution center, and at the point of sale location)
4. High transaction costs (increased by the large number of suppliers, the assortment of produce, traditional administrative systems, and less than sophisticated buying offices)
5. The tendency to “add value” (along with the necessary investments)
6. The right of consumers and customers to know the place of origin, the production methods, the use of pesticides and insecticides, adding higher costs.

The key factors for successful coordination in rank order included: trust, duration of relationship between customer and supplier, consistent behavior, reliability, year-round supply, exchange of market information, openness and honesty, a relative power balance, and direct communication.

Overall, the study uncovered the extreme importance of trust in relationships, where trust replaces monitoring and control. Trust underlies social ties and social contracts; and norms such as integrity, preserving relationships, and conflict handling enable the relationships.

Loader (1997) evaluated the true costs of conducting business, as a step toward improving systems and reducing costs. He used transaction economics to discuss relationships in the supply chain between Egyptian potato growers and consumers in the United Kingdom. His conclusions were that the importance of supply chain agreements increases when parties have highly dedicated assets, deal in large quantities, and when demand and supply is unpredictable. Dealing with a
single negotiator reduces transaction costs, in particular when large volumes pass through the channels.

The potato grower example shows a marketing system with many small scale producers using a low level of technology on one end, and on the other end thousands of consumers all consuming small quantities of the product. In between are six to eight major export companies and their respective import companies, and a variety of retail grocery and restaurant outlets with a large portion of the product being sold through a small number of large supermarket chains. As a result, there is a huge contrast between the producers and consumers, and the intermediaries who handle the product. The intermediaries operate in an uncertain environment in terms of supply and market for their product, so there is a drive towards vertical integration. Exporters are trying to purchase directly from farmers rather than from cooperatives and increasingly are looking at contracting with farmers to ensure a supply source. The contracts often are informal and subject to cancellation at short notice. The exporters have the advantages of better education and access to market information and the farmer is generally disadvantaged in both areas. The retail grocery sector is continuing to concentrate with centralized buying which means suppliers may deal almost exclusively with a single negotiator, thus decreasing transaction costs and suggesting that closer relationships will form. Also, relatively large consignments pass through these channels, further reducing transaction costs.

An important issue for all supply chains, including those in agriculture, is information sharing across the supply chain. An example of sharing information can be seen in the case of Capespan, a South African distributor of fresh produce (IBM, 1999). The company distributes 83 million cartons of fruit (three-quarters of a million tons), to 66 countries on six continents on 250 voyages, from 3000 suppliers in South Africa. They have an information system which links growers, port inspectors, customs brokers, shippers, retailers and storage firms. As a result, all
logistics and marketing data reach supply chain partners before the fruit arrives. A bar code system monitors all pallet movement and sales offices know what is available at any given time, which is very important given the perishable nature of the product. The flow of information allows Capespan to have the right product at the right place, not to worry about the logistics, and to focus on other business opportunities. Most growers are shareholders and are highly committed to the company’s success. However, the information system begins when products are delivered to the packaging facility rather than at the farm.

These examples provide anecdotal information for new biobased businesses. Much can be learned from evaluating other agriculture supply chains. In particular, issues of logistics, power between supply chain partners, marketing channels, quality, and information technology must all be considered in new biobusinesses. The specific kind of relationship between partners will be important, but all of these business practices also must be developed.
Agriculture Relationships

General buyer-seller relationships are discussed in the business literature and will apply equally well to agricultural biobased grower/processor relationships. There are many descriptions for the types of relationships that are most frequently used, but a general listing would include:

- Spot market transactions
- Contracts
- Quasi-Vertical Integration, Tapered Vertical Integration
- Cost-Plus Agreements
- Value-added Agriculture/Joint Ventures
- Strategic Alliances

The role of cooperatives also must be investigated as they have long been a mechanism for producers to gain access to input supplies and to shift the power in the market.

Spot Market Transactions

Much of the product currently transacted in agriculture is transacted through spot market transactions. With spot markets, there generally are large numbers of buyers and sellers and the product is traded through auctions, open bids, or from prices based on open market exchange. In spot markets there are multiple buyers and sellers and price usually determines the sale. Undifferentiated bulk commodity agriculture products in the United States are generally traded through spot market transactions. The products usually are considered low-value and are produced on millions of farms spread across the country. Farmers sell to traders, brokers, wholesalers or processors who then distribute them down the supply chain, eventually reaching retailers or for livestock consumption.

Contracts

Contracts in agriculture have been in place for several decades. Hobbs and Young (2000) discuss vertical coordination in agricultural supply chains. They note the trend in the United States
away from spot market transactions, toward closer vertical coordination along the supply chain. Contracts become more prevalent as buyers seek to gain access to product, and sellers gain assurance of market opportunity and lower their risks. They note that differentiated products specifically require more coordination. Technology is driving more coordination—as with company-specific crop varieties and large-scale production units. And, that regulation is driving more coordination—as with liability issues, traceability, and product standards. For financial gains, companies are moving toward more coordination, and as consumer preference for certain quality levels and for food safety increases, companies are coordinating with suppliers. Finally, product characteristics often drive coordination as with differentiated products, perishable products, or those with new (enhanced) characteristics.

Mighell and Jones (1963) identify three general classifications of contracts.

1. **Market-specification** – buyer agrees to provide a market for the seller’s output. The farmer retains control over the production process and the buyer may assume some risk and the right to make decisions over the timing of marketing. (cattle, malting barley)
2. **Production-management** – buyer specifies and/or monitors production practices, input usage, etc. (livestock, particularly poultry and hogs)
3. **Resource-providing** – buyer provides a market outlet, supervises production practices, supplies key inputs and assumes more risk (buyer may retain ownership of the product, farmer is paid a management fee) (close to vertical integration)

A full discussion of contracts is beyond the scope of this paper. Furthermore, contract law is specific to any one particular country and state. For more information on contract farming internationally, see Farm Management and Production Economics Service, Agricultural Support Systems Division, Food and Agriculture Organization of the United Nations (2004).

Martinez and Davis (2002) suggest that farmers must become more interdependent participants in the food supply chain, perhaps giving rise to more contracting and other forms of organizations in agriculture. They believe that demand for food products in the United States will grow slowly over the next 20 years. Based on that prediction, a food company’s growth will depend on lowering production costs, differentiating its products, producing higher quality
products at economical prices or expanding international trade. Coordination between agricultural production and processing will be essential to providing consumers with products that meet their demands for quality and variety. Examples of current contracts include:

- Frito-Lay contracts for specific types of corn for its Fritos Corn Chips.
- Smithfield Foods contracts for pork to produce Lean Generation Pork, a lean, branded fresh pork product
- McCain Foods produces one-third of all French fries consumed in the world, potatoes are grown by producers who enter into contracts before the year’s crops are planted

The authors note that contracts in the pork industry are increasing (Martinez and Davis, 2002 p. 35):

“Contract terms typically specify that producers will deliver a certain quantity of hogs to processors at a certain date. Producers may receive a formula-based price typically a hog price at a particular market location (for example, Iowa/Southern Minnesota), with premiums or discounts based on size and quality of the hogs. Processors may also specify that producers use certain types of inputs, such as specific genetic strains. Other types of contracts used in the hog industry give processors more control over the quality of hogs by allowing the processors to provide key production inputs. As in similar arrangements in the poultry industry, pork processors may own the hogs and establish contracts with farmers to feed the animals to market weight.”

In addition to the pork industry, more than half of all citrus fruits and processed vegetables in the United States are produced under contract. Contracts give vegetable processors control over planted acreage and planting dates to help ensure that processors receive a regular flow of raw product with desirable traits. Volume requirements of large retailers for items such as branded, fresh packaged salads has created growing interest in contracting as a means of procuring the desired volume, size, variety, quality and consistency of product.

Contracts have been in existence in the poultry industry since the 1950s. The industry has become more vertically integrated and horizontally consolidated with a few companies owning product inputs, processing, wholesaling, and distribution. Some evidence exists that the farmer/producer receives no returns above operating costs after including a modest return on labor
and depreciation (Taylor, 2002). He notes that with vertical integration, two conditions must exist for fair treatment of growers. The vertical supply chains must be extremely competitive with each other; as more horizontal integration occurs, there is less competition between supply chains. Second, there must be a balance of economic power between the vertical corporation and the contract grower. In the poultry industry, vertical integration has basically eliminated a spot market for the product, resulting in an imbalance of power in favor of the processor. He suggests that the imbalance in power could be restored through transparency in contracts and eliminating some deceptive practices in the contracts.

There are many examples of how large companies use contracting to gain access to new production locations or markets. Prater, Biehl and Smith (2001) describe the method Pioneer Hybrid used to gain access to Eastern European production sites and markets. Rather than buy land and grow and transport crops of their own, which would be typical in international locations, Pioneer contracted with farmers. The farmers grow and harvest grain, and deliver it to a storage facility. Pioneer provides a contract that guarantees farmers a minimum income regardless of the level of the harvest. Pioneer uses its resources to reduce the farmers’ risk of a poor harvest. Pioneer does not need an inbound transport system that could be used on the poor roads in that area. However, the company also does not directly control the farmers and must accept delays in harvest and delivery.

Another example of contract issues can be found in a discussion of contracts in the wine grape industry (see Fraser, 2003). Like other agriculture industries, changes in demand and supply have had an impact on this industry. An overbalance of the grape supply has led winemakers to select which grapes they will use and resulted in strained relationships with growers. The relationship between growers and wineries historically focused on the coordination of grape supply, including crop type and technology (production and processing), perishability and
bulkiness which require concentrated production and scheduling. This led to the use of contracts since the early 1990s. Contracts vary significantly in style and content; from informal contracts (verbal/handshake deals) where enforcement is by implicit cultural conventions, reputation, or repeated interaction to formal contracts (written) which may be incomplete in nature as many features are unstated and implicit. Three reasons for contracts in wine grapes are to:

1. Introduce certainty in grape and wine production (allowing for allocation of resources with greater confidence),
2. Allow market participants to share both financial and production risks, and
3. Potentially motivate performance by the use of bonuses and penalties.

The contracts are a trade-off between the extent that the winery provides “insurance” to a grower and the need to provide incentives to the grower to produce high-quality grapes given that the quality is not perfectly observable. The contract is complicated by the ability of the grower to shirk or satisfy the contract in suboptimal ways. Contracts are designed to offer incentives to prevent shirking without incurring excessive risk to the grower. This is implemented through contracts that contain a flat fee (the risk-sharing component) plus performance incentives (bonuses and penalties for quality).

Complicating the contracts are informational problems in the supply chain (i.e., the winery doesn’t know what the grower is doing, other than he has a capital investment which signifies his intention to do business). To minimize the effect of such problems, wineries contracts may include:

1. Grower visits to share information on vineyard management, discuss crop development, and coordinate harvest
2. Specifying input use (form of rootstock or choice of irrigation technology)
3. A measure of the quality of grapes supplied (measurement schemes are controversial)
4. Payments that are contingent on the price of wine in the bottle (lot tracing is more readily possible today)

Estimates of grapes grown under contract in both Australia and the United States range from 85 to 90 percent. Contracts have gained in importance when growers seek financial backing from their
banks. There is evidence that wineries are seeking security of supply by expanding their own grape production capability,

Some details on the wine contracts provide insight into the basics of other industry contracts (Fraser, 2003):

**Length** - Contract length is between three and ten years with an average length of 6.9 years in Australia and 3.5 in the U.S.

**Price** - There were numerous methods to set price in the contracts including: minimum price, fixed price for a fixed term with Consumer Price Index (CPI) indexing, market price, market price with fixed minimums and maximums, market price with bonus and penalty schedules and bottle price. Most often used in the United States was a reference price, such as industry-wide information similar to the average district price published by the California Agriculture Statistics Service.

**Harvest** - Contracts detailed harvest timing, method and bins for grape collection in only 25 percent of the contracts. However, wineries dictate when they will take the grapes, so the risks connected with leaving grapes on the vine longer than quality dictates rest with the grower.

**Quality** - Due to an excess supply of grapes, more wineries are including fruit quality requirements in contracts. Most contracts do not include a third-party evaluation of quality, so growers are at the mercy of winery quality assessments.

**Growing practices** - Wineries in general do not dictate viticultural practices but offer advice through regular visits or by dissemination of information through newsletters or grower meetings.

**Dispute resolution** - Some wineries include a dispute resolution method, but it is generally to resolve issues related to quality, not price.

**Contract renewal** - Wineries and growers generally had contract renewal clauses or evergreen clauses which specify the contract continues indefinitely unless one party gives notice of termination (generally two seasons).

Beyond contracts, wineries note the importance of trust and respect in relationships, as everything cannot be specified or enforced in a contract. In times of excess or under supply of grapes, contracts do not necessarily yield the best outcome to either party. There are many issues with how prices are set in the contracts. Indicative prices based on the previous year’s price by variety (for example) are only as good as the information in the formula. Also, when there is an
overabundance of grapes, wineries may ignore quality incentives as there is an excess of high-quality product. In general, growers will exchange price uncertainty for lower but certain returns.

As is true for many processors, wineries are viewed as having much more power in the relationship, partly because they have access to more information on wine demand and grape supply. This is evidenced by some contracts that allow cancellation based on “market disruption” in the demand for wine. One attempt to equalize the balance of power is for growers to form cooperatives. With a large number of growers and a small number of competitive wineries, it would be reasonable to expect some type of cooperation, but it is not common. The grower industry group is trying to agree to some standards across all contracts and is attempting to write a dispute resolution clause which would be included in all contracts.

Cost-Plus Agreements

Another type of relationship can be defined as a cost-plus agreement, where a processor or downstream supply chain partner agrees to pay the grower based on the actual cost of production. Yakima Chief, Inc., a hops marketing, warehousing and processing company (O’Connell, 2004) is an example of a cost-plus processor. In this case the processing enterprise also is an example of value-added investment, since the growers own the processing company. The company, owned by thirteen grower families, allows growers to maintain title to their hops all the way to the brewery gate. When the brewery pays the Yakima Chief invoice, the proceeds flow back to the grower with the company deducting fees for services performed. The arrangement is different from the standard business model in the hop industry where hops are bought from growers and sold to brewers in the traditional trader/merchant model with margins taken in the transaction. Yakima Chief has formed partnerships with large brewers which focus on cost transparency, tight specifications for better processing, product traceability, food safety and guaranteed supply. Other customers are evaluated for potential partnerships and where the potential exists they are treated
much as the partnership companies. Other buyers are viewed as spot buyers and supply is not guaranteed.

As O’Connell describes the partnership arrangements, they are contracts which lay out highly specific terms and conditions covering all aspects of the parties’ rights and responsibilities during a multi-year contract. A model is used to identify costs and thereby determine payment. The model presents “all economic aspects of farm production, Yakima Chief processing costs and operational efficiencies necessary to arrive at an auditable product price based upon a transparent formula.” The return to the grower is based on the average cost of production in the current crop year, a margin above the cost of production (realizing a return on assets) and three-year averages on yield per acre and product and product viability. Processing cost is reimbursed to Yakima Chief.

The model’s success has been attributed to benefits for all three entities—growers, Yakima Chief and brewer customers. The grower receives a known sales volume, has an easily understandable basis of farm return from known price, and his cash flow cycle is reasonably predictable. Yakima Chief has a known processing volume and valuable customers with solid relationships based on mutual benefits. The partner customer gets transparency and traceability back to the grower’s field, has his food safety concerns eliminated, receives a known variety (and associated functionality), and known costs and the basis for them. It is O’Connell’s view that a similar model could be appropriate to other industries providing the products marketed have a high “Relative Value” in relationship to the starting agricultural raw material. Relative Value is the ratio of “unit price of finished product” to “unit price of raw material.” When raw product is strictly traded on a standard contract, commodity-pricing basis without high relative value, the product price will not return a profit after application of costs of processing, information,
packaging and customer service. In addition, there must be a committed grower group willing to separate themselves, at least partially, from the “grow and deliver” farm model.

Another example of cost plus relationships is described by Hayward (2003). She describes a program between Asda, a large European retailer and division of Wal-Mart, and carrot farmers in Scotland. Begun in 1999, the “cost plus” scheme guarantees farmers a sustainable income for their crop, which includes a true cost of production. The carrot growers receive a fair price for their produce and have a committed customer for the volume of their product the next year. This initiative is part of a larger program to develop local sources of food in Britain.

Cost-based models for setting prices are being investigated in other industries such as in the transaction between feeder cattle growers and processors (Drovers, 2003). Some researchers suggest that retail prices along with the cost of processing and fabricating should be used to set live cattle prices. The problem with using retail prices is that they are generally not known until several weeks after the sale. Also, the costs of processing, fabrication, transformation, and transportation either are not revealed or are known only after the sale. Processors are not generally willing to divulge their costs, so the process becomes even more difficult as we add exporting and food service into the supply chain.

Fair trade

While not specifically a supply chain, market-based business model, a brief mention should be made of Fairtrade Labelling and the relationships established with producer/growers. Fairtrade was created in the Netherlands in the late 1980s (Fairtrade Foundation, 2004). The label Fairtrade was launched first on coffee sourced from Mexico in 1986 and today the Fairtrade Labelling Organizations International (FLO) sets standards and monitors products sold under the brand name. Producers who register with the organization receive a minimum price that covers the cost of production, they are offered up-front payments and loans, and an extra premium is paid which
must be invested in the local community to foster social and economic development. By 2004 there were 360 Fairtrade certified producer groups in 40 producer countries selling to hundreds of Fairtrade registered importers, licensees and retailers in 18 countries.

Fair trade products require the consumer to buy into the concept and be willing to pay an extra premium for the finished product. Examples of success with fair trade can be found at Race to the Top (Pye-Smith, 2004). In 1994, fair trade products retailed for 3 million British pounds and in 2002 they were worth 50 million pounds. Farmers sell through a cooperative which is also part owner in a processing company. The fair trade farmers may make up to twice the normal price for their products, but the amount sold is still very small. Fair trade has been extended from coffee and tea to mangoes, bananas, and chocolate, orange juice and wine.

Quasi-Vertical Integration, Tapered Vertical Integration/Franchise

Three other types of integrations are described by Fearne, Hughes and Duffy (2001). The first is quasi-vertical integration where buyers and sellers form a long-term contractual obligation and both parties invest resources. It is not truly a vertical integration arrangement as the agreement runs for a fixed time period and the firms remain independent. An example might be a joint venture where participants share the costs, risks, profits and losses, or a franchise or licensing agreement. A second type of integration is described as “tapered vertical integration” where a firm receives part of its supply through backward integration. For example, a beef processor may own some cattle on its own farms and buy the remainder from auctions or direct from farmers. The third type of integration is full vertical integration where a firm owns two or more segments of the supply chain.

Some authors suggest that franchising might be an appropriate model in some agriculture supply chains (Hobbs and Young, 2001). With franchises, a company (the franchisor) contracts
with the franchisee to provide a branded product or service. The franchisee generally pays an up-front fee to cover training and facility development and a royalty on revenue. The advantage to the grower is that the product is branded and they benefit from good decision-making skills and risk sharing.

*The Value-added Agriculture Model/Joint Ventures*

A recent trend in agriculture is for groups of growers to make investment in further processing their product (often termed value-added agriculture). Value added means that firms or groups of independent producers form a partnership or acquire a firm to complete another process stage, either upstream or downstream, in the supply chain. Some kind of value must result from the new business and result in increased profits for the investors.

Evidence from previous research at Purdue University (Fulton, 2000) suggests that in some cases the investment can be profitable for the producers. The farmer diversifies his investments beyond the farm, possibly into a more profitable business segment, and may benefit from government subsidies or incentives (as with ethanol production). However, in industries where rivalry among competitors is intense (as in the corn sweetener business) there is solid evidence that the existing competitors would react strongly to a new entrant and decrease the likelihood of profitability. Furthermore, it is difficult to get producers to commit to support an alliance over the long term and not to defect when prices elsewhere are higher. Fulton describes the necessary conditions for success as trust, commitment for the long run, communication, financial stability, positive benefits from working together, a small number of similar players, penalty for defectors, and a mechanism to share profits, losses and risk.

Nitschke and O’Keefe (1997) discuss the issues surrounding this business model in their evaluation of an Australian grain coop and its move to become a grain marketer, not just a grain trader. They note that value creation is not just the domain of individual firms, but rather is
accomplished by a system of businesses including retailers, exporters, packers, growers, input providers, manufacturers, etc.

For example, in horticulture, an Australian pear grower does not simply compete in Asian markets with a Chilean or South African pear grower. But the system of Australian growers-packers-exporters competes against the business systems of Chile or South Africa. It therefore follows that the competitiveness of the system is dependent on both the competitiveness of individual firms and the nature of the linkages between firms along the value chain. Further, the co-ordination mechanisms that are suitable for commodities – such as auction systems – are not appropriate for differentiated products and segmented marketing strategies. (Nitschke and O'Keefe, 1997 p.4)

They note that closer vertical coordination requires the farmer to relinquish control. However, farmers (in this case Australian farmers) generally place a high value on their independence and are extremely reluctant to cede any control or independence, especially to another party with whom they traditionally have had an adversarial relationship. Growers that used auction systems maximized their independence but their risks also were at a maximum. And, with independence and auction systems they did not receive specific customer feedback and they tended to be isolated from the rest of the supply chain.

They also noted that there are implications based on the size imbalance between individual growers and processors. When there are unbalanced relationships, such as the size imbalance between growers and processors, there are likely to be lower levels of cooperation and trust, higher levels of conflict and more instability. This has led growers to evaluate opportunities for further ownership down the supply chain into processing or even owning retail outlets for their product.

*Strategic Alliances*

Another type of relationship found in agri-industries and identified by Hobbs and Young (2000) is the strategic alliance, where both parties share the risks and benefits and both make decisions. These relationships often are flexible and trust-based and both parties work towards a
mutual goal. Both groups use their complementary assets to gain long-term competitive advantage. The relationships are often very broad and difficult to define by contract and generally need to be built over time. An example would be hogs that are sold to a specific processor by a group of producers who agree to meet certain quality characteristics. The processor also may have an alliance with a retailer who provides a branded product.

Hobbs and Young (2000) go on to identify implications of these new relationships for producers, producer cooperatives or commodity groups, and the government:

**Producers** – can add more value to their crops, must have new management expertise to evaluate production, marketing and relationship risks, need new skills in contract evaluation and negotiation, must understand the quality traits required by the buyer, and market price information is less valuable. Risk increases if the producer makes specific asset investments.

**Cooperatives or commodity groups** – increased role as intermediary to reduce negotiation costs between producers and processors, guarantee source of supply (to support a new processing plant), and may play a role in monitoring quality. The traditional role of lobbying for price floors may change to lobbying for things such as increased access to international markets.

**Government** – as identity-preserved products increase, commodity-oriented policies will become less relevant which reduces the need for average market price reporting by public agencies. This will be determined largely by how much of the overall volume is sold through identity-preserved supply chains. Today, these quantities are low, but growing.

**Commodity groups** – establish and operate quality assurance plans, monitor crop quality (especially for trait-specific products whose characteristics are not visible).

Adams and Goldsmith (1999) describe relationships which they call strategic fuzzy alliances. They describe these as trust-based relationships with the following characteristics: the boundaries between the firms are flexible and much less clear; there is shared control between the firms; knowledge flows easily between the firms; success is based on cooperation and using each other’s ideas to advance both firms; innovation and learning are encouraged to keep pace in the industry; in case of failure, exits costs are low and relations can be broken easily; partners are stakeholders but not necessarily shareholders in the operation; and the relationship is based on trust.
rather than being contract based. In fact they argue that without trust, fuzzy alliances cannot exist. For trust to exist they have found that knowledge of the other party’s business and the industry is required; predictability of the other firm or individuals must be present; the individuals or firm must have free will to trust the other; and finally, risk must exist because when outcomes are assured, there is no need for trust. Trust-based relationships do not require contracts or incur the costs of contracting; however, they incur the costs of acquiring knowledge of the other firm and building relationships.

The Role of Cooperatives

Agriculture cooperatives have long been a mechanism for producers to gain access to supplies and power in the market. Plunkett and Kingwell (2001) provide a taxonomy of cooperatives in Australia that illustrates their form, role, capitalization and level of producer commitment (see Table 3). The authors note that processing of farm products typically is capital-intensive, increasingly knowledge-based, and requires investment in technology, facilities and management. The structure of new generation cooperatives facilitates investment in such activity. By including delivery rights in shares, start-up funding is increased and borrowing requirements reduced. The quantity and quality of product is assured through delivery contracts. Other benefits to producers include: reassurance that other members are not able to behave opportunistically with regards to supply and quality of that supply, information about what is valued in the market, and reduction of risk. However, like any investment they are not without risk. Marketing cooperatives are a type of vertical integration, where the farmer owns assets further down the food processing or distribution system (Hendrikse and Bijman, 2002). Cooperatives are based on democratic decision making and raising equity capital among members.
<table>
<thead>
<tr>
<th></th>
<th>Cooperative associations</th>
<th>Service cooperatives</th>
<th>Supply cooperatives</th>
<th>Simple marketing cooperative</th>
<th>Processing and marketing cooperative (Traditional)</th>
<th>Processing and marketing cooperative (New generation)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What they do</strong></td>
<td>Member education; Product promotion.</td>
<td>Provide business management services, etc.</td>
<td>Provide inputs and services for agricultural businesses.</td>
<td>Negotiate prices; co-ordinate distribution.</td>
<td>Process and market members’ raw products.</td>
<td></td>
</tr>
<tr>
<td><strong>Capital requirements</strong></td>
<td>Usually very minor.</td>
<td>Can be minor, depending in the service.</td>
<td>Start-up costs reflect building costs and equipment.</td>
<td>Moderate start-up costs.</td>
<td>Typically involve significant start-up costs and require regular reinvestment to upgrade equipment and expand marketing.</td>
<td></td>
</tr>
<tr>
<td><strong>How they are capitalized</strong></td>
<td>Usually a nominal annual fee.</td>
<td>The co-op may borrow from members, from lenders, or sell stock or capital certificates to cover start-up costs. Thereafter, surplus from service fees and prices for goods may be allocated to member accounts but retained for a limited time to meet capital requirements.</td>
<td>The co-op may borrow from members, from lenders, or sell stock or capital certificates to cover start-up costs. Thereafter, capital retained is via charges per unit of members' product that is processed and/or marketed through the co-op.</td>
<td>The co-op may borrow from members, from lenders, or sell stock or capital certificates to cover start-up costs. Thereafter, capital retained is via charges per unit of members' product that is processed and/or marketed through the co-op.</td>
<td>Limited number of preferred shares sold to qualifying farmers at a price that reflects overall capital needs.</td>
<td></td>
</tr>
<tr>
<td><strong>How equity is returned</strong></td>
<td>Usually is not returned.</td>
<td>Typically revolved back to members over time.</td>
<td></td>
<td></td>
<td></td>
<td>Trade shares to other or new members. Share value reflects the co-op's performance.</td>
</tr>
<tr>
<td><strong>Level of product commitment</strong></td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Contracts may (or may not) bind a member to commit all or a set portion of his total production, but fixed quantities are usually not contracted.</td>
<td>Each purchased share commits a member to a specific quantity each year.</td>
<td></td>
</tr>
</tbody>
</table>

New generation coops (NGCs) are like coops in that each member has one vote and receives a distribution of profits based on patronage. With a NGC, a producer can own a piece of the processing, wholesale, distribution or retail sectors, and potentially earn a return on investment at any stage of the process. In addition, NGCs can issue shares that carry the right and obligation to deliver a specific amount of product to the coop. Members delivering their product into the system can expect an annual return on their investment in the form of patronage premiums. NGC shares are tradable and redeemable allowing members to get their equity out of the venture when they retire or quit farming. NGCs can have restricted membership and new members may have to purchase or lease delivery shares from someone else to become involved.

Parkland Industrial Hemp Growers Cooperative in Dauphin, Manitoba, Canada is a producing a biobased product using a NGC framework (BioProducts Canada, 2004). One hundred seventeen farmers organized in 1998 to produce hemp seed for processing into nutraceuticals, hand lotions, livestock protein supplements, birdseed and other items. After losing a major customer, the coop began processing hemp fiber for bedding for horses, strong paper and super-soft liners for winter boots. The NGC structure follows one established in the United States in North Dakota and Minnesota in the 1990s (Agriculture, Food and Rural Development, 2004). Some of the other NGCs in the United States include: Dakota Growers Pasta, the North American Bison Co-op and U.S. Premium Beef. Further information on NGCs can be found in an article on U.S. Premium Beef (Katz and Boland, 2000).
Agricultural Business Structures

Many companies, including agricultural companies, have adopted an integrated production and processing supply chain framework for organizing to meet end consumer demand. Supply chain management emphasizes the importance of communicating end customer product needs and specifications back through the supply chain to processors and producers. The goal is for the members of the chain to work together to remove barriers and bottlenecks in the chain and focus on reducing costs and improving quality at each stage. There is a consensus that development of biobased industries requires closer relationships between producers, processors and consumers along the supply chain. The issue for researchers is to determine what the nature of these supply chain relationships should be and how the farmer can maintain profitable participation in these new supply chains.

Ricks, et al. (1999) describe a number of common supply chain management needs from the perspective of an agricultural commodity industry, specifically the produce industry. These include (p. 47):

1. Development of a marketing or customer needs perspective and guidance of strategic directions versus a production perspective.
2. Analysis of the industry’s primary customer needs, the value chain, and hence opportunity for market expansion by the industry through the more effective servicing of changing customer needs.
3. Acquisition of continually updated information on the preferences, needs, and requirements of the industry’s customers.
4. Production and supply of and adequate quality of products to the industry’s customers, development and adaptation of new varieties, new products, and new uses of the industry’s products for changing customer needs.
5. Supply of consistent, adequate, but not surplus volumes when needed by customers.
6. Provision of consumer access through retail grocery shelves and through the menu offerings of food service retailers.
7. Means by which to overcome common obstacles for effective supply chain management from the commodity industry’s perspective including limited grocery shelf space, grocery firms’ category management, and slotting fees.
8. Development and expansion of export markets by meeting the special requirements for these markets in various export-receiving countries. They conclude that supply chain management strategies have been less well-developed at the farm level than for the other downstream firms. The farmer is typically focused on production of traditional crops at the lowest possible cost.

To begin to evaluate appropriate supply chain strategies for farmers, Tables 4-9 have been created to summarize the benefits and disadvantages for a number of different types of relationships. The tables identify the benefits and disadvantages for each supply chain member, including the community where the farmer/business resides. The relationships between supply chain partners further downstream from the processor may take many forms and are not dependent on the relationship between the farmer and the processor.
### Table 4: Spot Market Transactions for Growers

<table>
<thead>
<tr>
<th>Business Model</th>
<th>Benefits</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spot market transactions</td>
<td>* Known price</td>
<td></td>
</tr>
<tr>
<td>Grower</td>
<td>* Available outlets</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Established supply chain</td>
<td>* Price may be less than cost</td>
</tr>
<tr>
<td></td>
<td>* No negotiation opportunity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Does not consider product characteristics</td>
<td>* Lack of concern for sustainability by buyers</td>
</tr>
<tr>
<td>Processor</td>
<td>* Competitive bidding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Low or best price</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Consistent supply</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Potential high profits</td>
<td>* No guarantee of supply</td>
</tr>
<tr>
<td></td>
<td>* No differentiation of product</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* No quality assurance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Lack of product traceability</td>
<td></td>
</tr>
<tr>
<td>Further Processor</td>
<td>* Low or best price</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Potential high profits</td>
<td>* No differentiation of product</td>
</tr>
<tr>
<td></td>
<td>* Lack of product traceability</td>
<td></td>
</tr>
<tr>
<td>Retailer</td>
<td>* Low or best price</td>
<td>* No differentiation of product</td>
</tr>
<tr>
<td></td>
<td>* Lack of product traceability</td>
<td></td>
</tr>
<tr>
<td>Consumer</td>
<td>* Low prices</td>
<td>* No differentiation of product</td>
</tr>
<tr>
<td></td>
<td>* Lack of product traceability</td>
<td></td>
</tr>
<tr>
<td>Community</td>
<td>* Profitable businesses</td>
<td>* Unprofitable growers</td>
</tr>
<tr>
<td></td>
<td>* Disregard for environment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Unsustainable long term growers</td>
<td></td>
</tr>
</tbody>
</table>
Table 5: Contract Transactions for Growers

<table>
<thead>
<tr>
<th>Business Model</th>
<th>Benefits</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grower</td>
<td>* Known price</td>
<td>* May lose control of production process</td>
</tr>
<tr>
<td></td>
<td>* Assurance of market</td>
<td>* May lose control of inputs</td>
</tr>
<tr>
<td></td>
<td>* Lower risk</td>
<td>* May become process managers with little decision making</td>
</tr>
<tr>
<td></td>
<td>* May differentiate product</td>
<td>* May not provide a return above operating costs</td>
</tr>
<tr>
<td></td>
<td>* Improves traceability</td>
<td>* Quality monitoring may be skewed by the buyer</td>
</tr>
<tr>
<td></td>
<td>* Quality specified</td>
<td>* Risks of harvesting based on timing of processor demand</td>
</tr>
<tr>
<td></td>
<td>* May share financial risk</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* May receive incentives for some measure of output</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Minimal transaction cost</td>
<td></td>
</tr>
<tr>
<td>Processor</td>
<td>* Access to product</td>
<td>* Product may be poorer quality</td>
</tr>
<tr>
<td></td>
<td>* Known price</td>
<td>* Volume of product provided may not match demand</td>
</tr>
<tr>
<td></td>
<td>* Regular flow of product</td>
<td>* May increase financial risk</td>
</tr>
<tr>
<td></td>
<td>* Desirable product traits</td>
<td>* May increase cost of monitoring production</td>
</tr>
<tr>
<td></td>
<td>* Quality specified product</td>
<td>* May be a disincentive for input improvement</td>
</tr>
<tr>
<td></td>
<td>* Consistency of product</td>
<td>* May pay higher price</td>
</tr>
<tr>
<td></td>
<td>* Access to markets</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Payments may be based on product quality or tied to end product price</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Favorable cancellation policies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Minimal transaction costs</td>
<td></td>
</tr>
<tr>
<td>Further Processor</td>
<td>* Improved traceability</td>
<td>* Price may be higher</td>
</tr>
<tr>
<td></td>
<td>* Consistent product</td>
<td>* Volume limits may force purchase from multiple suppliers</td>
</tr>
<tr>
<td></td>
<td>* Stable price of product</td>
<td></td>
</tr>
<tr>
<td>Retailer</td>
<td>* Stable product price</td>
<td>* Price may be higher</td>
</tr>
<tr>
<td></td>
<td>* Promote known sources of products (locally grown)</td>
<td></td>
</tr>
<tr>
<td>Consumer</td>
<td>* Improved traceability</td>
<td>* Price may be higher</td>
</tr>
<tr>
<td></td>
<td>* Stable price</td>
<td>* Reduced choice of product</td>
</tr>
<tr>
<td>Community</td>
<td>* Can identify sustainable grower/processors</td>
<td>* May be unprofitable for growers</td>
</tr>
<tr>
<td></td>
<td>* Profitable businesses</td>
<td>* May be unsustainable long term for growers</td>
</tr>
</tbody>
</table>
Table 6: Cost-Plus Contract Transactions for Growers

<table>
<thead>
<tr>
<th>Business Model</th>
<th>Benefits</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Cost plus contracts | * Price covers cost of production  
* Lower risk  
* May differentiate product  
* Improves traceability  
* Quality specified  
* Reduced financial risk  
* Multi-year possible  
* Payment determined by cost of production formula  
* Reasonable cash flow cycle  
* Access to a committed customer | * Cost of identifying costs  
* Cost must include a return to operation  
* Increased transaction cost  
* Risk of cost being provided to competitors  
* Implied trust in the relationship  
* No guarantee of return when yields are poor  
* Information system required to capture and exchange cost information  
* Must have a group of committed growers to make feasible |
| Grower          | * Known processing volume  
* Price downstream can be negotiated based on input costs  
* May differentiate product  
* Improves traceability  
* Quality specified | * Variability in price over time  
* May be higher price  
* Increased transaction cost  
* Cost of information system  
* Customer may go elsewhere when market price is lower |
| Processor       | * Traceable product  
* Specified quality  
* Product differentiation possible | * Price may be higher  
* Price may vary with cost |
| Further Processor | * Traceable product  
* Can promote a product feature | * Price may be higher  
* Price may be more variable |
| Retailer        | * Differentiated product  
* Improved traceability | * Price may be higher |
| Consumer        | * Can identify sustainable growers/processors  
* Profitable businesses | * May be unsustainable long term for growers |
<table>
<thead>
<tr>
<th>Business Model</th>
<th>Benefits</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Tapered vertical integration/ Quasi-Vertical integration/ Franchise | * Long-term agreement  
* May maintain ownership independence  
* Share costs and risks  
* Provides basis for financing | * May be virtually an employee of the processor  
* May share in losses  
* May have little decision-making authority |
| Grower                                             | * Can specify inputs and other traits  
* Control of grower process  
* Quality standardized  
* Guaranteed supply  
* Differentiate product  
* Improved traceability  
* Price predictable  
* Lower transaction costs | * Higher investment  
* Tighter coordination required with growers  
* Legal limitations |
| Processor                                          | * Differentiated product  
* Improved traceability | * Higher prices  
* Lack of access to some product |
| Further Processor                                  |                                              |                                        |
| Retailer                                           | * Differentiated product  
* Improved traceability  
* Can promote a product feature | * Higher prices  
* Lack of access to some product |
| Consumer                                           | * Differentiated product  
* Improved traceability | * Price may be higher |
| Community                                          | * Profitable businesses | * May reduce the number of growers |
Table 8: Partnerships/Joint Venture Transactions for Growers

<table>
<thead>
<tr>
<th>Business Model</th>
<th>Benefits</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value-added agriculture/</td>
<td>* Increased profits</td>
<td>* Requires long-term commitment</td>
</tr>
<tr>
<td>Partnerships/joint ventures</td>
<td>* May improve government subsidies</td>
<td>* Requires a committed group of partner/growers</td>
</tr>
<tr>
<td></td>
<td>* Share losses and risks</td>
<td>* Defectors can sabotage the venture</td>
</tr>
<tr>
<td></td>
<td>* May differentiate product</td>
<td>* May give up some control</td>
</tr>
<tr>
<td></td>
<td>* May improve traceability</td>
<td>* Increased risk of secondary venture</td>
</tr>
<tr>
<td></td>
<td>* Better feedback from downstream customers</td>
<td>* Lack of knowledge in secondary business</td>
</tr>
<tr>
<td>Grower</td>
<td></td>
<td>* Costs of financing</td>
</tr>
<tr>
<td>Processor</td>
<td>* Guaranteed source of supply</td>
<td>* Grower/owners may have little processing knowledge</td>
</tr>
<tr>
<td></td>
<td>* Traceability</td>
<td>* Growers may defect</td>
</tr>
<tr>
<td></td>
<td>* Product differentiation possible</td>
<td>* Must compete with other supply chains</td>
</tr>
<tr>
<td></td>
<td>* Source of financing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Share risks and losses</td>
<td></td>
</tr>
<tr>
<td>Further Processor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retailer</td>
<td>* Traceability</td>
<td>* Possible higher prices</td>
</tr>
<tr>
<td></td>
<td>* Product differentiation possible</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Can promote product feature</td>
<td></td>
</tr>
<tr>
<td>Consumer</td>
<td>* Traceability</td>
<td>* Possible higher prices</td>
</tr>
<tr>
<td></td>
<td>* Product differentiation possible</td>
<td></td>
</tr>
<tr>
<td>Community</td>
<td>* Jobs and tax increases from new businesses</td>
<td>* May require government support for growers and businesses to be profitable</td>
</tr>
<tr>
<td></td>
<td>* Sustainability of growers</td>
<td>and sustainable</td>
</tr>
<tr>
<td></td>
<td>* Potential for sustainable practices</td>
<td></td>
</tr>
<tr>
<td>Business Model</td>
<td>Benefits</td>
<td>Disadvantages</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Grower</td>
<td>* Secure and stable market</td>
<td>* Relationship is based on trust</td>
</tr>
<tr>
<td></td>
<td>* Agreed-to price or price structure plan</td>
<td>* No penalty for processor defecting</td>
</tr>
<tr>
<td></td>
<td>* Share risk</td>
<td>* Requires sharing detailed information including costs</td>
</tr>
<tr>
<td></td>
<td>* May differentiate product</td>
<td>* Increased relationship costs</td>
</tr>
<tr>
<td></td>
<td>* Improves traceability</td>
<td>* No guarantee of return</td>
</tr>
<tr>
<td></td>
<td>* Quality specified</td>
<td>* Information system required to capture and exchange information</td>
</tr>
<tr>
<td></td>
<td>* Reduced financial risk</td>
<td>* Must have a group of committed growers to make feasible</td>
</tr>
<tr>
<td></td>
<td>* Multi-year possible</td>
<td>* Give up some independence</td>
</tr>
<tr>
<td></td>
<td>* Access to a committed customer</td>
<td></td>
</tr>
<tr>
<td>Processor</td>
<td>* Reliable source of product</td>
<td>* Relationship is based on trust</td>
</tr>
<tr>
<td></td>
<td>* Agreed-to price or price structure plan</td>
<td>* Growers can defect and product supply disintegrate</td>
</tr>
<tr>
<td></td>
<td>* Share risk</td>
<td>* Requires sharing detailed information</td>
</tr>
<tr>
<td></td>
<td>* May differentiate product</td>
<td>* Increased relationship costs</td>
</tr>
<tr>
<td></td>
<td>* Improves traceability</td>
<td>* Information system required to capture and exchange information</td>
</tr>
<tr>
<td></td>
<td>* Quality specified</td>
<td>* Must have a group of committed growers to make feasible</td>
</tr>
<tr>
<td></td>
<td>* Reduced financial risk</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Multi-year possible</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Further</td>
<td>* May differentiate product</td>
<td>* Possible higher prices</td>
</tr>
<tr>
<td>Processor</td>
<td>* Improves traceability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Quality specified</td>
<td></td>
</tr>
<tr>
<td>Retailer</td>
<td>* May differentiate product</td>
<td>* Possible higher prices</td>
</tr>
<tr>
<td></td>
<td>* Improves traceability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Quality specified</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Can promote product feature</td>
<td></td>
</tr>
<tr>
<td>Consumer</td>
<td>* Traceability</td>
<td>* Possible higher prices</td>
</tr>
<tr>
<td></td>
<td>* Product differentiation possible</td>
<td></td>
</tr>
<tr>
<td>Community</td>
<td>* Can identify sustainable growers/processors</td>
<td>* Supply chains must be competitive for all partners to be sustained</td>
</tr>
<tr>
<td></td>
<td>* Potential for sustainable practices</td>
<td></td>
</tr>
</tbody>
</table>
As producers look to develop relationships with major manufacturers and retailers, individual farmers may want to consider aligning themselves further down the supply chain and think about certain necessary elements (Thompson, 2001). The key requirement is for an integrated system which links production with point of sale allowing information to flow up and down the supply chain. The product must be of the highest quality and meet all the regulatory and consumer requirements. The producers must be able to provide a consistent supply of product. They should consider linking with processors who have the initiative and capacity to develop new products. At the same time, they must work with buyers to provide price stability. Farmers must acquire a marketing perspective of the supply chain rather than a production view and have a preference for long-term commercial relationships.

The agricultural food industry has been slow to build trust-based relationships between supply chain partners. O’Keeffe (1998) identifies four key characteristics which hinder trust-building in agriculture supply chains:

- In commodity markets the sum of value created is fixed and the major issue is how it is divided among channel participants. This is a win-lose game and leads to adversarial relationships;
- Auction systems and regulated markets isolate farmers from the rest of the food system and farmers do not gain any insight into their customers, and why they act the way they do. Likewise processors have not needed to, or had the opportunity to, develop relationships with growers;
- Supply chain management does not remove the volatile nature of prices and supply – both quantity and quality - characteristic of agriculture. Price volatility puts pressure on the relationship;
- Interdependence is difficult to achieve owing to size imbalance between processors and farmers.

These issues must be considered as farmers move to change the nature of the relationships in their particular supply chains.
Conclusions

The purpose of this paper is to investigate supply chain business relationships that would be most appropriate for biobased businesses. A framework is required that identifies the business structures available to farmers producing products to serve the new bioindustries which translate into wealth creation for farmers. Clearly, the manner in which biobased businesses are developed will have tremendous implications for the future wealth of Iowa’s farmers and communities and for the economic condition of the state. While there may be great opportunities for large-scale farms that use best practice management standards to succeed in the new bioeconomy, it is more difficult to envision the role of the mid-sized farmer. How should these farmers look to improve their profitability as they begin providing products to biobased processing companies?

An initial literature review provided a background on supply chain practices and identified best practices in supply chain management. A discussion of existing agricultural business supply chain practices was included. Finally, a complete discussion of possible business structures was developed along with an analysis of benefits and disadvantages for all links in the supply chain. While none of the models provides the perfect solution for farmers, the benefits of long-term strategic alliances that are based on trust between partners appear to have the most potential for new biobased businesses.

There are several limitations associated with these findings. The purpose of this research was to identify possible business supply chain relationships that would provide an equitable return to farmer/producers. The scope of the research was too broad and was difficult to cover fully in a reasonable literature search. In formal peer-reviewed agriculture journals alone, a 2001 study found a total of 123 journal articles relating to chain management in the agri-food industry.
Cunningham (2001). Those were articles published prior to August 2000. The number of articles since that date is likely to be significantly higher. These numbers indicate the difficulty of paring down this amount of literature in a reasonable review. Articles could be segregated by commodity type and country or continent but that does not suggest how they might aid in a review of business relationships. In addition, many other government reports and private company analyses also are readily circulated and available via the Internet. Supply chain literature in general is extensive, including numerous journals, books and web site publications which could apply to agriculture. The result was an exhaustive group of materials to evaluate and no reasonable method to segregate it for this project.
References:


