INFORMATION TECHNOLOGY IN AGRI-FOOD SUPPLY CHAINS

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EXECUTIVE SUMMARY

High-tech information systems can be a source of competitive advantage to agri-food firms when they support a supply chain strategy that suits the demand for the product. Understanding the difference between supply chains for functional versus innovative products is an important first step. Functional products, with their stable demand and commodity nature, would use automated systems that reduce the costs of production and handling. Innovative products have much higher value added, which justifies expenditures on a responsive supply chain to prevent over-supply and out-of-stocks. Systems to understand and predict consumer demand are critical to an innovative product supply chain. Managers of agri-food supply chains face complications from the fact that their products are not always clearly distinguishable as functional or innovative. Food safety and quality concerns may dictate supply chain approaches.

Information systems in agri-food can be a source of competitive advantages to the entire supply chain, to the extent that information is shared. Economic concentration and mistrust in agri-food industries inhibits the information sharing that is needed for a responsive supply chain based on information technology. The major systems in food chains today are implemented at retail, giving retailers the opportunity for chain leadership through their information advantages. Food retailers can use their advantage to pressure suppliers or instead they can work toward improving performance of the entire farm-to-retail chain.

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ABSTRACT

High-tech information systems can offer competitive advantages to agri-food firms when the systems support a supply chain strategy that suits the demand for the product. This article discusses differences between supply chains for functional versus innovative products and the relevance for managers in agri-food firms. Unique characteristics of agriculture and food products and economic concentration in food industries affect the appropriate supply chain approach.

by Victoira Salin

Introduction

Many firms and inter-firm alliances use high-tech systems to facilitate information gathering and exchange. Agribusinesses use information technology (IT) to varying degrees, as revealed by interviews with managers in the cattle-beef chain (Salin, Lowe, and Krueger). The use of point-of-sale scanners in retail food is well-known. Meat packing and distribution companies use IT to automate delivery and billing, and retailers are striving to complete the implementation of scanner systems for fresh meat. The uneven adoption of IT along the farm-to-retail chain, and across firms, points to potential strategic advantages for some firms. Delays in adopting IT could prove costly, because information that provides competitive advantages serves as a strategic resource (Sonka, Hofing, and Changnon, 1988).

Here I consider the strategic role of IT from a supply chain perspective. The question is whether IT and the information gathered in an IT system provide a competitive advantage to an entire chain, to each firm in the chain, or just to some parts of the chain. The agri-food chain encompasses firms in each level of the farm-to-table market channel (Schmid).   Multi-level chains characterize many agricultural product handling systems. Another feature of agri-food chains is that some products are transformed from commodity to differentiated branded foods, while others undergo packaging but remain essentially homogeneous in character.

Successful IT-based coordination between firms and suppliers or distributors occurs in several industries, including airlines and fresh-cut flowers (Applegate and Gogan). IT systems for food firms can be multi-million dollar investments (Gorman), so it is important to consider their value carefully. It may be that features of agri-food chains will inhibit the success of information technologies.

Food: Functional or Innovative Products?

Ideas from management science suggest that characteristics of agricultural products should be considered in decisions about IT-based coordination of the supply chain (Fisher). The nature of the product being sold is the main factor in answering Fisher's question... "What is the right supply chain for your product?" Understanding whether the product is "functional" or "innovative" is the key. Functional products are staple goods that have predictable demand. Innovative products are differentiated, have many varieties, and usually exhibit short life cycles. The differences in consumer demand for the two product types call for different supply chain management approaches, including how to use IT in chain operations.

A supply chain manager for a functional product should reduce costs of the physical functions along the chain, according to Fisher. Production, transportation, or inventory management are the some essential functions that are well-suited for IT systems aimed at cost-reduction. Typical examples of IT for physical functions include the automation of ordering processes and payment mechanisms, scheduling of warehousing and delivery, and control systems for quality assurance in production. An innovative product's supply chain should focus less on costs and more on delivering the attributes that consumers desire. Managers should emphasize understanding and reacting to consumer demand, and choosing suppliers based on speed and flexibility. Companies introducing innovative products do not know at first how much will be purchased, so the ideal supply chain is responsive. Managers of a responsive supply chain use IT systems that link orders to sales, or just-in-time production, in order to limit stockouts or overstocks. While a responsive supply chain might not be the least cost in terms of physical delivery of goods, the value gained by reducing lost sales or unsold inventories of the higher-valued innovative products leads to greater total profit in the chain. IT systems in agri-food consistent with a responsive chain are scanner data collection and customer loyalty cards, which enable food retailers to understand and predict consumer desires.

Firms in the food industry will face difficulties with using a product-based classification system to decide on appropriate IT systems, because food and agricultural products can be either functional or innovative. Basic foods are functional (flour, sugar), but many food and fiber products are increasingly differentiated, either through genetic development or value-added processing or packaging. Consider the case of the cattle-beef sector to illustrate the potential difficulty in classifying goods as functional or innovative. Both functional and innovative meat products might be produced from the same animal, depending on the stage of processing. Even at retail, ground beef in 2-pound packages has a relatively predictable demand and would be considered a functional item. The same retailer might offer beef cuts packaged with special ingredients, or fully cooked meals--highly differentiated, innovative products.

IT systems are important to firms in some levels of the cattle-beef supply chain but adoption is incomplete, and not being pursued by all firms (Salin, Lowe, and Krueger). Some of the chain relationships between processors and retailers are consistent with the classification of beef as a functional good. At ranches and feedlots, information systems are used to track costs of feed. Electronic data interchange between a meat packing company and its largest customers reduces the cost of ordering and handling, consistent with a functional paradigm.

Other linkages along the cattle-beef supply chain are more applicable to an innovative product. Managing a responsive supply chain can be accomplished by out-sourcing production to closely-linked suppliers who can provide the specific attributes. For example, intermediate processors grind beef and supply standard patties to their quick service restaurant customers. An alternative way to maintain the supply chain for an innovative product is to keep production closer to the consumer. Grocery store delis and bakeries are examples. The higher labor cost of these foods prepared in the store could be offset by savings from fewer over-stocks and rapid response when stocks are depleted.

Unique Features of Agri-Food Chains

Agri-food supply chain managers must be concerned with control of food quality and safety, and with the potential for weather-related supply variability. These concerns, unique to the food sector, may justify a different approach to supply chain management than the product-based approach suggested by general management theory.

Perishable goods, like food, require a time-efficient supply chain, even if rapid delivery is costly. For example, Frito-Lay, Inc., uses an IT system that includes hand-held computers operated by field sales staff (Applegate). The improvements in product monitoring and reductions in delivery time cut the cost of goods expiring in warehouses. Even non-differentiated perishable foods may require investments in IT that make the system responsive enough to prevent spoilage. Food safety issues are hand-in hand with supply chain choice. Proper monitoring and response to food safety problems requires the ability to trace back small lots, from retail to processor or even to the farm. IT systems involving bar-coded products at all stages of processing can make the tracking more feasible.

Supply variation due to biological cycles and weather causes food input costs to vary. Raw material costs are not easily controllable, and perhaps not even predictable. Firms might respond by focusing attention on improving distribution, where costs are more controllable. Or firms can form alliances with suppliers who can deliver goods even during times of relative shortage. Supply unpredictability also causes managers to focus on improving their understanding of commodity markets, using a variety of information sources from outside their firm, including government-provided information.

Seasonality of agricultural production, particularly for crops, can affect supply chain approaches. A food processor such as Campbell Soup Company faces a short window for most of its production, close to the vegetable harvest season. No amount of IT investment could eliminate the need for extensive storage of products for a business that is highly seasonal.

Industry Structure and IT-Based Chain Relationships

Inter-firm information networks allow companies to manage supply sources and distribution networks without owning them (Applegate and Gogan). Continuous information exchange helps to cement the relationship, as firms in a close partnership open up their books to each other. Information sharing enables the firms to identify which partner performs the needed functions at least cost. Then efficiencies along the entire chain can be enhanced by moving activities to the least-cost partner. IT used in this way can generate information that serves as a strategic resource to the chain.

Economic concentration and power imbalances can inhibit the birth and survival of IT-based alliances. High economic concentration in food retailing in the United Kingdom and Australia is associated with low trust and prevents the development of positive supply chain relationships (Hogarth-Scott and Dapiran). Agricultural industries in the United States often are characterized by a funnel shape of concentration along the market channel.   There are usually many producers, but concentration tends to increase at the processing level. At retail, there are again many firms. The changes in economic concentration along the supply chain complicate management, because there are many options for partnering. It is physically difficult to maintain close relationships with many suppliers or many retailers, even using advanced information technologies. Processors tend to offer electronic links to their largest retail customers. The high cost and complexity of these systems promotes concentration because the largest processors choose to ally with partners who have the resources to undertake sophisticated IT--usually another large firm.

IT is a valuable tool for creating a supply chain that is capable of rapid response, but it has its limits. The point-of-sale scanner is the key IT tool for tracking retail demand in the grocery industry. Some grocery chains analyze their scanner data immediately and are then in a position to motivate response by their suppliers. The scanner information becomes a strategic resource to that individual company.   Suppliers may benefit, if the retailer shares the information with them, thus providing the potential for enhanced performance of the entire chain. Many retailers submit their scanner data to private companies (Nielsen and IRI), which clean and aggregate the market information and sell it after a 4-week delay. This aggregate information is the only source for upstream firms to learn about consumer demand, unless they have a special relationship with a retailer. Aggregate scanner information shows recent market shares but it is not timely for creating a responsive supply chain. The aggregate scanner information is available to all firms at the same time, so it is not a source of competitive advantage.

Conclusion

An assessment of product characteristics is a good starting point for agri-food supply chain managers to prioritize their IT investments. Different IT systems are appropriate for functional versus innovative products. The challenge for management is to decide how to classify their product, and to accommodate multi-food businesses in which some lines are functional and some are innovative.

Good IT systems in agri-food can generate information that will bring competitive advantages to the entire supply chain, to the extent that information is shared. Information

sharing along the chain helps to lock in selected partners and is not generally pro-competitive. The major IT systems in food chains today are implemented at retail, giving retailers the opportunity for chain leadership through their information advantages. Food retailers can use their advantage to pressure suppliers or instead they can work toward improving performance of the entire farm-to-retail chain.

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