

Supply Chain Management and the Changing Structure of U.S. Organic Produce Markets

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Abstract

We present the results of a survey of the organic produce supply chain in the U.S., focusing on supply chain dynamics and firm behavior with a view to changing market forces. The survey suggests firms are projecting increased activity with organic products, but they are changing the way they are sourcing from their suppliers. Shippers and wholesalers are using more, larger suppliers to provide a greater proportion of their produce. There is an increasing prevalence of contracting for both organic and conventional produce. The expanding presence of the mass merchandisers in organic produce is expected to actually stimulate demand for product from growers, but it also leads to an increased competition for suppliers. There is significant effort to coordinate a variety of business functions between shippers and organic suppliers.

Keywords: supply chain, produce, organic, vertical coordination

1. Introduction

Agricultural economists and food industry analysts have devoted a substantial research effort to document and understand the emergence of the organic sector in the U.S. agriculture and food industry. Numerous studies have investigated the determinants of consumer demand for organic products and the reasons for which consumers are willing to pay a price premium over conventional products (Thompson, 1998). The existence of organic price premiums, in turn, provides incentives for organic farmers to expand their production scale, and for conventional producers to convert to organic production systems (Oberholtzer, Dimitri, and Greene, 2005). The adoption of organic farming practices by U.S. farmers propagated rapidly throughout the 1990's (Greene and Kremen, 2003). In 2001, 2.34 million acres of cropland and pasture were certified organic, representing 0.3 percent of U.S. cropland and pasture.

While organic food sales still account for a small proportion of total food sales, retail sales of fresh organic produce and organic processed foods and beverages have been rising dramatically since the early 1990's (Dimitri and Greene, 2002). Preliminary results from the Organic Trade Association's (OTA) 2006 Manufacturer Survey indicate that U.S. organic food retail sales amounted to about \$14 billion in 2005, that is, 2.5 percent of total food sales, up from 1.9 percent in 2003 (OTA, 2006). Sales of fresh organic fruits and vegetables have contributed a lot to the surge in organic food sales. The food retail sector has changed markedly in response to a growing consumer demand for organic foods. Natural foods stores have entered the retail sector, and conventional retail outlets have taken steps to expand their organic food offerings. Conventional supermarkets now represent the largest retail outlet for organic foods before natural foods stores (Dimitri and Greene, 2002). Moreover, new processed organic foods and beverages are being introduced at a relatively high rate, which is an evidence of the dynamic of organic food markets.

Meanwhile, the implementation of the National Organic Program in 2002 has helped to resolve the asymmetric information problem associated with the credence characteristic of organic products with different certification requirements in each state. The use of the National Organic Standards has lowered transaction costs between farmers, handlers, and the buyers of organic commodities, and has heightened the credibility of organic

certification to consumers. National standards may have also sparked a structural shift in organic markets due to the adverse effects of certification costs on small firms in the supply chain (Greene, 2000). The introduction of a national certification system has most likely contributed to increase the supply and demand for organic products. The fact that the value of organic produce rests on a credence attribute may have implication for the management of the supply chain. The marketing process from farm-gate level to retail must convey information not only about prices but must also ensure the transmission of credible but unobservable production practice attributes to the consumer. As the distance between the farmer and the consumer widens, as is often the case in marketing goods within industrialized countries and across country borders, the level of credence becomes more difficult to establish. Therefore, a number of interesting supply chain issues may arise in connection with the distribution of organic foods. In addition, the supply chain for organic produce may face constraints similar to the one in the produce industry where significant consolidation has taken place.

This study examines the recent changes taking place in the organic produce supply chain. Specifically, the objective of this study is to describe and analyze the behavior of firms within the organic produce distribution system, the challenges they face, and the adjustments they make. The dynamics of vertical business relationships are explored under conditions of trading a highly specific asset that is perishable, requires special identity preservation, and has a distinct market segment into which it is being marketed. Many of the factors impacting the supply chain for organic produce are factors impacting the trade of all produce. Retail trade is consolidating, but special markets are emerging for natural foods products, as well. This study looks at trends in supplier relationships, sourcing, contracting, marketing, and system coordination, paying special attention to the middle handlers of fresh organic produce.

1.1. The growth of organic produce markets

Organic food trade and trade in organic produce in particular have been greatly affected by the establishment of national quality and definition standards. Klonsky and Greene (2005) summarize organic sales figures, noting the increase from \$3.5 billion in 1997 to

\$10.3 billion by 2003, with fruits and vegetables comprising over 40% of the most recent sales data. In 2003, fresh produce made up over 90 % of organic produce sales.

The adoption of organic production systems has happened to a greater extent in the fruit, vegetable, and other high-value crop sectors. In the 4th National Organic Farmers' Survey (hereafter referred to as NOFS) from the Organic Farming Research Foundation (OFRF) (Walz, 2004), organic farmers growing vegetable crops and fruit and nut crops represent 70 % of the respondent population (43 % for vegetables and 27 % for fruits and nuts); organic vegetable and fruit and nut sales account for the largest share of organic farm sales (29 % and 20 %, respectively), amounting to 49 % of total sales. In 2001, approximately 1.6 percent of the total U.S. vegetable acreage was certified organic, after a 15 percent expansion since 2000. Lettuce, tomato and carrot crops occupied most of the organic acreage. Approximately 1.3 percent of the total U.S. fruit and tree nut acreage was certified organic in 2001. Certified organic fruit and tree nut cropland was up 28 percent from 2000. Certified organic acreage was allocated mostly to grape, apple, citrus, and tree nut production (Greene and Kremen, 2003). Recent studies have explored trends in the organic sector at the farm level (MacInnis, 2004; Walz, 2004) and at the retail market level (Klonsky and Greene, 2005). None of these studies, however, explored the changes taking place with respect to the handling of organic produce between the farm and the retail market.

1.2. Changes in the U.S. fresh produce distribution system

Several studies have explored the recent dynamics of the produce industry (Kaufman *et al.*, 2000; Calvin and Cook, 2001; Perosio *et al.*, 2001). These studies have explained the impacts of changing consumer preferences, retail consolidation, growing sophistication of communication within the supply chain, technical progress in post-harvest handling, and new marketing and trade practices on the organization of the fresh produce distribution system.

Many changes have occurred in the U.S. fresh produce industry. Fresh produce per capita consumption has steadily increased over time and the quality of produce has improved. Supply chain management efforts have contributed to reduce non-value-adding transaction costs and have supported the use of contracting between retailers and their

suppliers. Changing consumer preferences (the demand for convenience and diversity for example), and the quest for scale economies and minimum transaction costs have fostered consolidation at all levels of, and influenced the modes of vertical coordination within the distribution system. The structural change in the distribution system requires agents involved to coordinate more closely and share more information with each other.

The fresh produce distribution system has also been evolving with the emergence of new retail entities, especially because produce departments contribute a great share of total store profits. Food sales from supercenters have grown at a high rate during the 1990's. Adoption of the integrated wholesale-retailer configuration with centralized buying operations acting as distribution centers handling large volumes in a more efficient manner has also affected the produce industry. This type of retailer organization has eased cold chain management, and facilitated communication with suppliers. Terminal markets are used occasionally and more often for specialty produce. The development of mass merchandisers and consolidation of retail chains have given more buying power to fewer large firms with consequences on produce procurement. In particular retail-price fixity may be reduce grower/shippers welfare. Consolidation has resulted in more direct buying from large shippers, with a rising use of automatic inventory replenishment technology as a means to minimize inventories. Consolidation at the retail is also prompting suppliers to consolidate or at least engage in strategic alliances in order to gain bargaining power, facilitate year-round supply of produce, exploit scale and scope economies, and minimize transaction costs.

Recent data like those from the PMA *FreshTrack 2001* (Perosio *et al.*, 2001) have shown that retailers are looking to larger suppliers and compressing the supply chain. The share of produce bought by retailers and directly shipped from growers to supermarket distribution centers, possibly with the intervention of a broker, is on the rise. Direct buying is a rising trend for most commodities and this method of procurement usually accounts for the majority of produce procured for retailers, or even foodservice distributors. The volume share of U.S. produce moving through terminal market wholesalers has been decreasing. 21.5 percent is bought from a produce wholesaler, and 3.1 percent is procured from a general-line wholesaler. Functions of wholesalers and intermediary handlers include repacking, segregation, sorting, preparation for marketing,

cleaning, ripening, packaging, storing, price discovery role of wholesale markets. Wholesalers primarily deal with independent retailers and foodservice establishments. Consolidation at the wholesale level has followed retail consolidation. Direct buying has taken the place of traditional methods of procurement such as terminal markets and produce sourced from brokers. Smaller firms still (in 2001) buy mostly from produce wholesalers for their produce sourcing, but sourcing direct from grower/shippers is on the rise also for them as they also diversify their supply sources.

Fresh produce markets are above all characterized by perishable products, seasonal production, and a strong dependence of supply on climatic conditions. These characteristics entail high degrees of uncertainty and risk about market prices and quantities, which has traditionally deterred the use of forward contracts in produce trade and favored spot market transactions. However, consolidation in the fresh produce industry has stimulated the use of forward contracting (Calvin and Cook *et al.*, 2001). Large retailers have reduced the share of their produce purchases on spot markets. More and more retailers, large and small, are using some type of contract for at least some share of their produce purchases. Large firms use contracts to a greater extent than small ones. This is a well documented trend in the produce industry: using spot transaction less, and using contractual agreements more despite the significant volatility of fresh produce prices posing difficulties to contract specification. Contracting allows the parties of a transaction to reduce their price, quantity, and quality risks; it may reduce their transaction costs associated with merchandising and advertising, planting, harvesting, and packing decisions. In addition, retailers have introduced formal performance guidelines applying to produce suppliers to measure their performance. Large firms use this type of supply-chain management tool to a greater extent, although this practice is on the rise for small retailers, too (Perosio *et al.*, 2001).

1.3. Challenges for the management of the organic produce supply chain

While the studies cited above describe important developments in produce trade, they do not specifically focus on organic produce. Organic produce has a number of distinctive characteristics from conventional produce that make it a particularly interesting case study in supply chain evolution. The economic factors driving the trends in the U.S.

produce industry impacts organic produce as well, especially the consolidation in the organic marketplace. Small produce growers currently must try to coexist with larger produce growers that have increasingly important scale economies. These two types of producers tend to use different market channels to sell their output (Krissof, 1998). Larger producers tend to sell their output to large food processors or retailers directly, or to wholesalers, as they become more integrated in the supply chain, and as retailers require the provision of more services like year-round supply, a specific timing of delivery, specific packaging, participation in category management and merchandising. Small-scale organic vegetable producers tend to use direct-to-consumer market channels, direct-to-grocery retailers market channels and grower cooperatives more than larger-scale growers. The latter sell their a greater share of their output to packer/shippers, brokers, and food processors (Fernandez-Cornejo *et al.*, 1998) The future of these different channels will likely impact the viability of smaller scale producers.

Furthermore, some market and regulatory conditions have been identified as having adverse impacts on the economic sustainability of organic farm operations. Under the National Organic Program, organic farmers and handlers (shippers, packers, distributors, and food processors) must be certified, at a substantial cost, by State agencies or private organizations according to the national organic standards developed by the USDA. They are exempted of this requirement if their annual sales of organic agricultural products are less than \$5,000. Organic produce handlers must prevent the contamination of produce by substances prohibited under the USDA organic standards and ensure the segregation of organic and non-organic produce. Also, grower/shippers and middle handlers may encounter difficulties to obtain organic price premiums compensating the higher costs of producing and handling organically grown produce. At this time, the organic produce industry lacks marketing networks and sources of market information which make it difficult to secure a consistent supply or have access to reliable sales outlets. Production areas are spread out and remote from terminal markets and middle handlers. Market conditions are often unstable due to events of overproduction, shortage, and lack of information.

There are a number of interesting supply chain issues connected with the distribution of organic foods. Some manufacturers and distributors are specialized in organic foods

while some others added organic products to the conventional product line they already had. Natural-food retail stores are thriving but conventional food stores are rapidly gaining market shares in organic food sales (The Food Institute, 2005). Product differentiation in the organic segment presents its own set of challenges with complex labeling laws and stocking fees. Retailer concentration has led to more integrated distribution and asymmetric market information, especially on price. A major difficulty for organic food retailers and processors consists of securing an adequate supply of organic products that are uniform in size and quality. To overcome this difficulty, manufacturers frequently cooperate with farmers through technical and financial assistance in order to obtain appropriate inputs. Like in the conventional produce sector, although price remains an important factor determining commodity trade between a buyer and a seller, such factors as quality, variety, information, safety, taste, and reliability play an equal or greater role than price. The problem specifically for organic produce is that non-price factors are subject to asymmetric information during the negotiation process.

This study examines some of the difficulties in sourcing organic produce. Our basic hypothesis is that, although derived demand is expanding, intermediaries have a more difficult time sourcing adequate supplies of quality product. Conventional produce has moved more to year-around sourcing, drawing heavily from international production regions. Relatively little organic produce, however, is sourced outside of the U.S.. Our expectation is that this would lead to evidence of more contracting with growers, intermediaries dealing with larger, presumably more reliable, suppliers, and generally more active business-to-business sharing of information. Stronger vertical relationships are expected to be present in relationships with organic produce to avoid hold-up problems, reduce supply uncertainty, capture rents, and meet the anticipated expansion of demand driven by the emergence of the natural foods stores and mass merchandisers – the “mainstreaming” of organic products.

2. Sample data collection and description

2.1. The Red Book Credit Services database

A list of organic produce handlers was extracted from the Red Book Credit Services online database. All organizations dealing with organic produce were selected from the database regardless of their business focus. We obtained a list, containing mailing and e-mail addresses and fax numbers, of 390 firms and trade associations active in the organic produce sector. Trade associations listed in the RBCS database were excluded from the final list. Firms in the list have diverse roles and positions within the distribution system: they are growers, shippers, brokers, packers, wholesalers and other distributors of fresh organic produce, retailers, or a combination of these functions.

2.2. Survey instrument and method

Data about organic produce handlers subscribing to the RBCS were collected using a mail survey. The questionnaire was sent in early May 2006 to these firms on the list. Follow-up mail, e-mail, and fax requests to fill out the survey were also addressed to the firms in order to gather more observations. In the questionnaire, respondents were asked to provide information about their firm and supply chain management practices. Several questions asked for information about their situation in 2001 and their expectations five years into the future through the year 2011 in addition to the current situation. We collected 37 surveys usable to conduct our analysis.

2.3. Firms' characteristics

Marketing channels for organic produce are similar to the ones for conventional produce. The various organic fresh fruits and vegetables marketing channels are summarized as follows:

- (i) Farm → shipper → wholesaler and/or broker → natural foods retailer or conventional foods retailer or foodservice establishment
- (ii) Farm → shipper → natural foods retailer or conventional foods retailer
- (iii) Farm → direct-to-consumer markets

In the reality, firms may be variously integrated among the functions of growing, shipping, packing, wholesaling, brokering, and even retailing. It is challenging identifying and evaluating distinct actors in the supply chain. In any case, many intermediaries exist to provide these various functions, and this study seeks to examine how these firms interact and how changing market dynamics are affecting their behavior. Firms in our sample are heterogeneous as they intervene at various stages of a complex produce distribution system. They perform at least one these activities: grower, shipper, packer, re-packer, wholesaler, importer, or retailer. Most firms actually execute several of these activities. Usually, growers also perform packing and shipping activities. Some growers are active on a wholesale market. Large organic growers may also carry out the marketing of their own production and the production of other growers, contract part of the production with other growers (Greene and Kremen, 2003), take charge of distribution through grower/shipper-owned distribution centers, arrange exports, etc. Some wholesalers are also active in the retail sector. The proportions of firms involved in various activities are reported in table 1.

Table 1. Sample proportions for activities

Grower	48.7%
Shipper	48.7%
Packer	43.2%
Broker	21.6%
Wholesaler	35.1%
Retailer	13.5%
Importer	2.7%
Exporter	2.7%

The proportions in table 1 indicate that firms are vertically integrated at different points along the supply chain. Our sample contains a large number of firms positioned upstream in the supply chain (growers, shippers, packers) and a significant proportion of wholesalers. Over 40% of the respondents assumed 3 or more of these activities within their firm. While both forward and backward integration can be observed, there is also ample evidence of specialization in the organic produce sector. Not every grower can

readily provide both conventional and organic produce. Economies, if they are to be captured, are generally pursued through increasing volumes of one product or expanding the number of products, but within the organic or conventionally produced category – at least at the grower level.

Data collected with the 4th National Organic Farmers' Survey shed light on the composition of our sample of organic produce middle handlers. For organic vegetables, the estimated volume based on acres produced and sold through consumer-direct channels (no middle handlers) was about 13 percent in 2001. The estimated volume sold by producers through direct-to-retail channels was about 53 percent. Natural foods stores accounted for 15.7 percent of the sales volume. Conventional retail stores represented 35.1 percent of the volume sold. The estimated volume sold through wholesale market channels was 34 percent. In this category, buyers from natural foods store chains accounted for 5 percent of the sales, buyers from conventional supermarket chains 4.7 percent, distributors or handlers 13.5 percent, and independent brokers 2.6 percent. Processors, mills and packers accounted for 7.3 percent of the volume sold. For organic fruits, the estimated volume based on acres produced and sold through consumer-direct channels was about 11 percent in 2001. The estimated volume sold through direct-to-retail channels based on acres produced was about 12 percent. Natural foods stores accounted for 9.9 percent of the sales volume. Conventional stores represented 1.46 percent of the volume sold. The estimated volume sold through wholesale market channels was 77 percent. Buyers from natural foods store chains account for 7.2 percent of the sales, buyers from conventional supermarket chains 1 percent, distributors or handlers 27.4 percent, and independent brokers 11 percent. Processors, mills and packers accounted for 28.5 percent of the volume sold. Thus, all types of wholesalers and retailers have a major role in the organic produce supply chain, and these firms are well represented in our sample.

Firms in the sample are also characterized by their size and the number of commodities they handle. Most of the firms (68 percent) had their annual sales in 2005 comprised between \$1 and \$25 millions. 16 percent of the firms had sales less than \$1 million and 16 percent had annual sales greater than \$25 million. Table 2 contains the average

number of stock keeping units (SKU's) for all produce types and for organic produce only, five years ago, currently, and as expected five years into the future.

Table 2. Average produce SKU's and share of organic produce sales of firms surveyed

	2001	2006	2011
Total warehouse produce SKU's	295.3	597.7	1075.3
Organic produce SKU's	207.8	310.4	591.3
Organic produce percentage of total produce sales	64.4%	62.2%	60.9%

The average SKU's reported in table 2 are reflective of the trends observed for fresh produce in other studies (Perosio, et al, 2001). The SKU averages for all produce type and for organic produce are informative. They have increased markedly over the past five years, and among those in the industry they are expected to rise much further in the next five years. Organic items require their own SKU. Wholesalers expanding to carry both conventional and organic would expect to see an increase in the number of SKUs they manage. The share of organic produce sales is expected to stay roughly around 60% for the firms surveyed. If one considers the percentage of organic produce sales out of total sales as an indicator of the degree of specialization in organic produce, this result can be attributed to two factors. First, produce handlers already involved in the organic produce supply chain do not become more specialized in organic produce; second, traditional produce handlers are entering the organic produce sector with a relatively low volume of organic sales. In any case, the logistics management challenge will be increasing for those in the distribution channel as they expand the number of products they track in inventory.

3. Organic produce procurement

3.1. Changes in the number of suppliers

Respondents were asked to provide information about their supply sources for conventional and organic produce at different points in time. Average numbers of produce suppliers and supply sources concentration are presented in table 3.

According to the data, both the number of conventional produce suppliers and the number of organic produce suppliers have increased, in roughly the same proportions, in the recent past, and are expected to increase substantially during the next five years. Produce handlers were asked to report the percentage of their organic produce purchases procured from their top three suppliers. The reliance of produce handlers on their three largest organic suppliers has decreased over time. Currently, 73 percent of organic produce is sourced from the three largest suppliers, down from 75.8 percent in 2001.

Table 3. Average number of produce suppliers

	2001	2006	2011
Produce suppliers	33.2	57.2	81.6
Organic produce suppliers	23.7	39.7	64.6
Organic purchase share for top 3 suppliers	75.8%	72.7%	65.8%

Their dominance as suppliers is expected to decline slightly in the next five years, down to 65.8 %. This decline in the concentration of supply sources contrasts with the changes taking place at the retail level for general produce (Perosio *et al.*, 2001). This trend in organic produce procurement could be explained by various causes. First, handlers are diversifying their sources of organic produce because they market a greater variety of commodities and they seek to reduce their supply-side risk. Second, suppliers are becoming more specialized as they exploit scale economies in production and marketing of organic produce. Third, large conventional produce handlers are entering the organic sector of the produce industry and they tend to have a larger than average number of suppliers.

3.2. Changes in the modes of vertical coordination with suppliers

3.2.1. What is vertical coordination?

Agricultural markets have undergone a noticeable structural change. The degree of agricultural commodity differentiation has increased. Agents in agricultural markets have reduced their reliance on spot markets for raw commodities. Instead, vertical coordination has become tighter between primary producers and downstream agents. These trends and other changes have contributed to what is referred to as the

industrialization of agriculture (Barkema *et al.*, 1991). According to one of the hypothesis advanced by agricultural economists (see Streeter, Sonka, and Hudson [1991] for instance), the activities undertaken by producers, processors, and distributors to differentiate food products and convey information about product differentiation and quality have increased transaction costs. Despite technical progress, these additional transaction costs must be reduced through greater vertical coordination among agents in the food system, which would contribute to the structural change observed in agricultural and food markets.

The food system has traditionally relied on price signals to coordinate the activities in a supply chain. However, the use of production and marketing contracts, and vertical integration has expanded as coordination mechanisms. Mighell and Jones (1963) state that vertical coordination “includes all the ways of harmonizing the successive vertical stages of production and marketing. The market-price system, vertical integration, contracting, cooperation singly or in combination are some of the alternative means of coordination” (quoted from Hobbs [1996]). Thus, vertical coordination is ubiquitous in economic activities and takes multiple forms. Vertical coordination is a more comprehensive concept than vertical integration, capturing the following modes of organization: spot markets, where coordination is based on price signals; contracts; full vertical integration, where transactions/activities are conducted within firms and are coordinated by managerial direction. Mighell and Jones discuss several administered arrangements – contracts – for vertical coordination in the food sector. They identify three general contract types¹: market specification contracts; production management contracts; resource providing contracts.

Transaction costs economics (TCE) hold that transaction costs affect the organization of economic activities, in particular the vertical coordination of economic activities. The key insight provided by TCE is that, *ceteris paribus*², economic agents will carry out vertical coordination between different stages of a production, processing, and distribution chain,

¹ These contract types follow the progression of increasing dominance by one party, characteristic also of Williamson’s classification (classical, neoclassical, and relational contracts).

² Transaction costs are only one of a number of potential determinants of vertical coordination. The decision for a firm whether to vertically integrate also depends on the presence scale economies, sunk costs and capital requirements, risk considerations, tax liability, and other relevant factors that make the integration more or less efficient.

through the use of both market and non-market arrangements, in the most transaction-cost-efficient manner (Coase 1937, Williamson 2000). The TCE approach to the theory of the firm has been criticized, however. In particular, it may be an overstatement to claim that minimizing transaction costs is the central explanation for vertical coordination in the food system or another sector of the economy. Cost minimization is central to the choice of governance structure in Williamson's transaction economics. Critics of the TCE approach (e.g., Boon, 1999) advance that strategizing – the creation of economic rents through strategic initiative – is essential to the choice of organizational structures. Strategizing decisions are concerned with the creation of rents through strategic initiatives; while economizing is concerned with increasing rents through reducing transactional inefficiencies. Similar critics are formulated in the literature about the capabilities approach to the firm (Richardson, 1972).

3.2.2. Challenges in coordinating procurement activities

While price remains an important parameter determining fresh produce trade between a supplier and a buyer, such factors as quality parameters (appearance, taste, flavor, ripeness, etc.), variety, origin, growing practices, and food safety play an equal or greater role than price (Perosio *et al.*, 2001). A major obstacle to carrying out transactions under these conditions is that non-price factors are very often subject to asymmetric information in the exchange process. As the seller-buyer relationship becomes more complex, transaction costs incurred during the exchange increase and some specific arrangements may be necessary to minimize these costs. In addition, organic vegetable and fruit production requires idiosyncratic investments. Organic produce are even more specific than conventional produce. Organic produce marketing may necessitate a more formal type of supply chain management than spot markets, like contracts or technical assistance. Transaction costs in sourcing organic produce may be significant and could be reduced or eliminated through integration or the use of contract arrangements.

Important transaction costs to consider in organic produce trade are the followings:

- (i) Costs associated with uncertainty and search to obtain information about prices, quantity, quality, origin, and costs due to temporary shortages or surpluses, etc.

(ii) Costs associated with bargaining and agreeing on prices, monitoring production practices, ensuring food safety, testing for quality, etc.

(iii) Costs associated with spoilage, loss and transportation, payments, etc.

Growth in organic sales might be very dependent on the ability of the industry to bring to market a consistent supply of diverse food products marketed by large-scale supermarkets. According to the CEO of Whole Foods, “fresh produce [is] one of the most challenging product categories to operate due to the limited shelf life of the products and the high cost of spoilage. Whole Foods invested heavily in developing expertise, building its own national distribution network, and aligning with local suppliers, to ensure the best quality.”(Wells and Haglock, 2005) Supply uncertainty may be significant in the organic produce supply chain and may generate transaction costs. Quality (especially quality consistency) is another important variable subject to uncertainty in the organic produce supply chain. Table 4 reports respondents’ assessment of a set of items representing potential sources of transaction costs in the procurement of organic produce.

Results indicate that, currently, finding adequate suppliers, obtaining competitive prices, the seasonality of supply and quality consistency are seen as major sources of transaction costs. As respondents look back at the past situation, seasonality is rated as the major challenge in procuring organic produce five years ago.

Table 4. Average ratings of potential sources of transaction costs ^a

	2001	2006
Finding adequate suppliers	2.0	2.1
Obtaining competitive prices	2.1	2.0
Adequate assortment of SKU’s	2.0	1.8
Seasonality of supply	2.2	2.1
Quality consistency	2.1	2.0
Distribution efficiency	2.0	1.8
Spoilage loss	1.7	1.5
Packaging consistency	1.8	1.6

^a Rating is based on the following scale:

1 = no significant challenge 2 = some challenge 3 = substantial challenge

Handlers were asked to rate the following as “challenges you face in sourcing organic produce”.

The importance and persistence of seasonality as a challenge in procurement may be due to insufficient production across regions with different climatic conditions and lack of contra-seasonal imports. A previous study by Park and Lohr (1996) found that seasonality has a negative impact on organic broccoli and carrots long-run equilibrium wholesale market quantity. They suggest that smoothing out seasonal variations for some organic commodities, through better coordination of planting and harvesting across production regions, could favor market expansion. Carrying an adequate assortment of produce, however, has become less challenging over the past five years. This improvement in the organic produce supply chain is explained by the growth and diversification in organic farming in the recent years. The distribution system for organic produce has become more efficient according to the respondents, and this gain in performance is accompanied by a better packaging and spoilage avoidance.

On the supply side, it is important to note that organic farmers have identified some priority areas to improve the marketing of certified organic products (Walz, 2004): local and regional organic market development, organic price reporting services, having directories of organic product buyers, wholesale market information and development.

3.2.3. Geographical distance to suppliers

The location of suppliers is an important element of vertical coordination, especially in a sector where commodities are perishable and transportation costs are high. Survey results indicate that, on average, 38% of organic produce purchases are procured from suppliers located less than 100 miles from handlers, in 2006. The proportion of local purchases has slightly decreased since 2001, down from 41%. The share of purchases sourced from remote suppliers (more than 100 miles and more than 500 miles away) has been stable since 2001. However, the proportion of purchases from foreign markets has noticeably increased from 17% in 2001 to 21% in 2006. These results can be compared to the data from the NOFS. According to that survey, respondents predominantly sold vegetable products locally, with 79 % of vegetable products sold within 100 miles of the farm. Local sales of fruit, nut and tree products are also substantial with 43 % of the volume sold based on acres produced. However, fruits tend to be shipped farther away from the

production area, with 19 % and 32 % of the volume sold to buyers located between 100 and 500 miles, and more than 500 miles from the production area, respectively.

3.2.4. Characteristics of organic produce suppliers

The choice of suppliers is a central decision of the procurement process. Thus, organic produce handlers were asked to characterize how the profile of suppliers from which they procure organic produce had changed from 2001 to 2006. Table 5 contains detailed information about these organic produce suppliers.

Table 5. Characteristics of organic produce suppliers

	Rating ^a
Average size of organic suppliers	3.8
SKU's per supplier	3.5
Purchasing from suppliers specializing in organic	3.6
Number of conventional suppliers newly offering an organic produce line	3.9
Use of e-commerce with suppliers	3.7

^a Rating is based on the following scale:

1 = large decline 2 = slight decline 3 = stable 4 = slight increase 5 = large increase

There is evidence of a moderate increase in the size of organic suppliers. This result is interesting given that the proportion of small-scale farming operations is larger in the organic sector than for all U.S. farms overall. A comparison with data from previous OFRF surveys shows that producers with certified organic farmland under 50 acres have become a smaller percentage of OFRF survey respondent population, dropping from 63 percent in 1993 to 61 percent in 1997 and to 54 percent in 2001. The percentage of respondents' certified organic acreage between 50 and 179 acres has risen from 19 percent in 1993 to 20 percent in 1997 and to 25 percent in 2001. The percentage of respondents with certified organic acreage between 180 and 499 acres has risen from 10 percent in 1993 to 13 percent in 1997 and to 14 percent in 2001. Data from the 2002 Census of Agriculture depict a similar situation. The 2002 Census of Agriculture contains

a new item which is land used to grow certified organically produced crops.³ The percentage of farms between 1 and 49 acres producing some certified organic crops is 46.4 percent. The percentage of farms between 50 and 179 acres producing some certified organic crops is 27.8 percent. The percentage of farms between 180 and 499 acres producing some certified organic crops is 15.2 percent. For comparison, the percentage of farms between 1 and 49 acres with harvested cropland is 26.4 percent. The percentage of farms between 50 and 179 acres with harvested cropland is 31.1 percent. The percentage of farms between 180 and 499 acres with harvested cropland is 21.8 percent. According to the NOFS, in 1995, the percentage of respondents grossing \$30,000 or more was 31 %, rising to 35 % in 1997, and 43 % in 2001. Thus, the proportion of organic farmers earning higher incomes has been rising over the past decade. As the organic food sector is growing and becoming mainstream, organic produce farming and handling operations are probably adjusting their scale of operation upward to exploit scale economies and be more efficient. However, the increase in the variety of products (SKU's) carried by a typical supplier seems to be less significant. This observation is consistent with the pursuit of scale economies through increasing the volume of a limited set of products.

According our survey respondents, there are also more and more conventional produce suppliers entering the organic produce sector. The importance of suppliers specialized in organic produce has increased only slightly.

Vertical coordination is evolving toward a greater use of e-commerce but this trend is moderate. The rise in the use of e-commerce underscores the concern about efficiency gains in the coordination between sellers and buyers of organic produce.

3.2.5. Cooperation with suppliers

Respondents were asked whether they currently cooperate with suppliers by providing them with different sorts of assistance in production and marketing. Numbers reported in table 6 represent percentages of the respondent population for all possible answers for each item.

³ The count of farms growing certified organic crops is obtained from the answers of respondents. Reports are not verified with certifying organizations, thus this item may not match estimates from other sources.

Table 6. Cooperation with suppliers of organic produce

	No	Some	Extensively	More than with conventional growers	
				Yes	No
Production planning	38%	31%	31%	67%	33%
Input purchases	53%	37%	10%	56%	44%
Technical field assistance	73%	10%	17%	44%	56%
Financial assistance	66%	21%	14%	55%	45%
Organic certification	59%	24%	17%	N.A.	N.A.

Production planning appears to be the most frequent and comprehensive mode of cooperation with suppliers. Interestingly, the majority of respondents judge that implementation of production planning is more important with organic growers than with conventional growers. Organic produce handlers may undertake such cooperation to reduce supply uncertainty and smooth out seasonal variations in production across suppliers. Cooperation through input purchases seems less intense but relatively frequent. The adoption of this type of cooperation as well as the importance of financial assistance in the organic sector as stated by respondents may be attributed to the greater asset specificity observed in organic production. Input purchases and financial assistance are means to induce optimal investment in production in order to obtain organic produce with specific attributes. Cooperation through technical field assistance and for certification is not as widespread as other modes of cooperation.

3.2.6. Contracting

Respondents were asked whether they resort to contracts with suppliers to obtain some kinds of guarantees on supply. The proportions of purchases carried out under contracting at different points in time are reported in table 7.

Table 7. Percentage of produce purchases procured under some kind of contract

	2001	2006	2011
Conventional produce	16.2%	18.2%	25.0%
Organic produce	33.0%	35.9%	50.1%

Contracting has been used more extensively with organic produce than conventional produce among our sample of respondents. Currently, about one third of organic produce purchases are done under some kind of contract. The use of contracts is also expected to be greater for organic relative to conventional produce in the near future.

According to the NOFS in 2001, 86 % of vegetable products produced were priced at delivery with no forward contract, while 14 % of products were sold under forward contracts. The dominant form of arrangement for this product category is short-term forward contract (season/year), entered at the beginning of the growing season or one year ahead of delivery. 39 % of fruit, nut, and tree products were sold under forward contracts. This proportion of contracting is consistent with our results. For this category, contract forms mostly used are short-term forward contract (season/year) (14 %) and long-term contract (more than one year or several years ahead) (16 %). The increasing use of contracting may favor large suppliers who can guarantee to meet contract terms on large volume with a consistent quantity and quality, year-round. To achieve these objectives they may have to produce in different climatic regions and organize the distribution efficiently.

4. Organic produce marketing

4.1. Expectations about demand for organic produce

Overall, organic produce handlers expect a strong increase in demand for USDA-certified organic produce over the next five years. However, they expect the demand for certified-sustainable and eco-labeled produce to remain stable in the near future.

4.2. Distribution of output among sales outlets

There exists a variety of sales outlets for organic produce supplied by middle handlers: conventional grocery retail stores, natural foods supermarkets, foodservice establishments, direct sales to consumers (farmers' markets, Internet, etc.), wholesaler/distributors, and food processors. Since retail stores and foodservice absorb the great majority of general produce, table 8 reports the shares of organic produce sales for these primary marketing outlets.

Table 8. Share of sales by sales outlet

Market Outlet	Share of sales
Conventional grocery store	26.7%
Natural foods store	40.1%
Foodservice firm	11.0%
Other	20.7%

Organic and natural stores represent the largest sales outlet for organic produce handlers, absorbing roughly 40% of sales. Conventional grocery retail accounts for more than one fourth of the sales volume. Sales to foodservice firms are limited to about one tenth of the sales volume. The rest of the organic produce is sold to other handlers (other wholesalers for instance), food processors, and farmers' markets.

4.3. Marketing constraints

Table 9 reports the average ratings given by organic produce handlers to various potential sources of transaction costs in selling organic produce.

Table 9. Average rating of constraints in marketing organic produce ^a

	2001	2006
Merchandising support	1.8	1.8
Slotting/promotional fees	1.5	1.5
Trace-back demand	1.6	1.7

^a Rating is based on the following scale:

1 = no significant challenge 2 = some challenge 3 = substantial challenge

None of the three potential sources of transaction costs in table 9 received high ratings, which indicates that they are not very challenging obstacles to marketing organic produce. Merchandising support received the highest score for five years ago and the current period. This result is consistent with the recent trend according to which retailers are asking their suppliers to be more involved in category management, ad and promotion planning, etc.

4.4. Consequences of the entry of mass merchandisers on supply chain structure

Respondents were asked to assess the impacts – potential and already observed – of the entry of mass merchandisers on the organic produce supply chain and the environment in which they operate. Table 10 reports the expressed opinions of respondents about several potential consequences.

Respondents appraised the greater demand for organic produce and more intense competition for access to suppliers as the most significant consequences of the entry of mass merchandisers in the organic sector. The latter consequence is related to the tendency of large retailers to use direct buying as the primary way to procure fresh produce. Not surprisingly, organic produce handlers also anticipate sales to large retailers to increase.

Significant price premiums for organic produce have prevailed through the 1990's and early 2000's (Oberholtzer, Dimitri, and Greene, 2005). Oberholtzer, Dimitri, and Greene report that monthly market margins at the wholesale level were higher for organic broccoli and carrots than for conventional equivalents over the period 2000-2004. For the same period and the same commodities, organic price premiums were larger at the wholesale level than at the farm level. For these commodities, price premiums have been steady over the 2000-04 period.

Table 10. Impacts of mass merchandisers in the organic produce sector

	Insignificant	Some	Significant
Lower margins for organic produce	42.4%	39.4%	18.2%
Greater demand for organic produce	9.4%	46.9%	43.8%
Increased competition for suppliers	25.0%	31.3%	43.8%
Increased selling to large retailers	12.9%	48.4%	38.7%

Respondents do not anticipate margins on organic produce to decrease significantly following the entry of mass merchandisers in the organic segment. This expectation is consistent with the fact that a significant part of the price premium for organic produce comes from higher production and handling costs.

5. System-wide issues

Lastly, respondents assessed the relative importance of several supply-chain management issues and their involvement in dealing with issues relevant to the organic produce supply chain. These critical issues are some of the ones identified by retailers and grower/shippers who participated in the *FreshTrack 2001* study. For each issue, respondents were asked to what extent they have invested resources to deal with that issue. Values reported in table 11 are percentages of all answers for any item.

In the *Freshtrack 2001* report, among the most critical issues identified by both grower/shippers and retailers were food safety, quality specifications, vendor partnerships, and produce traceability. According to our survey, critical issues for the organic produce supply chain are HACCP standards, third-party certification, product traceability, the management of the cold chain, and the specification of quality standards. Almost half of the respondents agreed with the statement that quality specifications are more important for organic produce than conventional ones.

Table 11. Supply chain issues

				Is this issue more important for organic produce?		
	No	Some	Extensively	No	Same	Yes
HACCP standards	31.0%	34.5%	34.5%	36.0%	48.0%	16.0%
Third-party certification	17.9%	42.9%	39.3%	12.0%	32.0%	56.0%
Product traceability	14.3%	42.9%	42.9%	28.0%	40.0%	32.0%
Cold chain maintenance	20.8%	45.8%	33.3%	25.0%	50.0%	25.0%
Quality specifications	14.3%	46.4%	39.3%	26.9%	26.9%	46.1%
Information sharing (EDI)	46.4%	35.7%	17.9%	42.3%	42.3%	15.4%
Demand forecasting	32.1%	46.4%	21.4%	36.0%	32.0%	32.0%
Category management	40.7%	48.2%	11.1%	38.5%	42.3%	19.2%
Returnable containers	53.6%	28.6%	17.9%	32.0%	48.0%	20.0%
Pallet bar coding	77.8%	22.2%	0.0%	47.8%	47.8%	4.4%
Cross-docking	33.3%	59.3%	7.4%	34.6%	46.2%	19.2%
Inventory turns	44.4%	51.9%	3.7%	40.0%	40.0%	20.0%
Vendor managed inventory	74.1%	22.2%	3.7%	56.0%	36.0%	8.0%
Automatic inventory replenishment	85.2%	11.1%	3.7%	64.0%	32.0%	4.0%

It appears that there are other supply chain issues less important than the ones cited above but for which some resources have been devoted to deal with them. These issues are demand forecasting, category management, cross-docking, and inventory turns. These issues reflect the current trends in the fresh produce industry where suppliers become more involved in retail-store level category management and agents seek to reduce non-adding-value costs in the supply chain.

6. Conclusion

The organic supply chain is dynamic. This study documents many of the recent changes that have taken place within the system in terms of structure, conduct, and performance. The actors within the supply chain have become more integrated and will likely continue

to do so. We expect to see more contracting, an increase in planning and distribution of products, and a continued increase in the grower size and number of products distributors are sourcing from them.

Many of the factors that are driving change in organic produce are connected with main line produce. The movement toward wider distribution through mass markets, however, will impact the organic supply chain specifically. Growers and distributors of organic produce expect to see demand for organics increase even more, but distribution also to become more challenging.

The organic supply chain is highly integrated with the conventional produce supply chain, but it also exhibits certain distinguishing characteristics. The products are highly specific, even more sensitive to quality, and involve the added dimension of identity preservation through many handlers. The supply chain is going through rapid evolution following the adoption of national quality and marketing standards, as well as the rising concern for healthy products from consumers. It creates an important case study for economists that are interested in better understanding integration, coordination, and supply chain performance.

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