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Maximizing Freight Movements in Local Food Markets

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Literature Review

As interest in local food continues to grow, both practitioners and planners are seeking ways to scale up local and regional food distribution to expand the availability of local products in new and larger markets. Increased demand for local products from mid to high-volume buyers has revealed inadequacies in distribution systems designed for farm-direct sales on the one hand, and high volume, national broad-line distributors on the other. Because producer profit margins are slim and consumer prices for local products are high (compared to conventionally sourced products), targeted interventions aimed at enhancing economic efficiencies in mid-scale food distribution and logistics shows promise as a strategy for keeping local food prices competitive in the marketplace while ensuring fair returns for farmers.

Methods of assessing the environmental impact of local and regional food supply chains are still in their infancy. “Food miles” are likely the most popular and consumer-friendly measure, though, as a measure, they have been critiqued for several reasons.

- There is no agreed upon framework with explicit boundaries (Edwards-Jones et al., 2008).
- There is too little consideration of economies of scale (Mariola, 2008).
- They fail to account for the environmental impacts of other actions along the supply chain, such as energy used in production or energy used along a cold-chain (Sim et al., 2007).
- Food miles figures do not account for the energy wasted to produce and transport perishable product that is ultimately wasted (Vanek & Sun, 2008).

Accordingly, some researchers have pointed to life-cycle assessments as a better tool to evaluate products’ environmental impacts (Edwards-Jones et al., 2008; Sim et al., 2008). These assessments, however, are complex to formulate and expensive to conduct.

Given the lack of consensus about how to calculate such measures, the utility of food miles and life cycle assessments are only tangentially relevant to this study. The goal of this research is to evaluate whether and how freight infrastructure and movements can be utilized to more efficiently distribute local food. Here “efficiency” is concerned with maximizing multiple factors including economic, social, and environmental performance intended to increase the resiliency of the food system at a regional scale. Toward this end, we take a more nuanced approach that considers all of three of these factors when characterizing the supply chain. Specifically, what are the opportunities and strategies available to maximize these benefits in local food distribution? How can existing supply chain research and strategies inform this question? These questions are beginning to shape the dialogue around local food supply chains, some of which is discussed below.

Challenges to building regional food systems include:

- Conventional produce is fully integrated into institutional, restaurant, and supermarket supply chains and according to Meter (2009), these systems have grown more complex over time, which, according to Diamond, Barham and Tropp (2009), increases the barriers to entry for new producers, including strict requirements for packaging and grading standards.
- Food safety certifications and related software are increasingly required or preferred, such as third-party certifications or radio-frequency identification (RFID), which allows for real-time product tracking (Martinez & Thornsbury, 2006; Tondel & Woods, 2006; Saddle Creek Corporation, 2007). However, both are costly, putting smaller companies at a distinct disadvantage.

- Balancing economic, social, and environmental values presents challenges. A 2010 USDA Economic Research Service report compares how different scales of supply chains—direct, intermediated, and mainstream—balance these three values (King et al., 2010).
- Product pricing presents challenges as well. If a price is too low, the producer cannot make enough profit, but if the price is too high, consumers may opt for cheaper conventional alternatives. Different supply chains result in different pricing structures; for example, mainstream supply chains yield commodity pricing, and direct supply chains leave price-making to the producers (King et al., 2010; Meter, 2009).

Regional food system supply chain strategies for efficiency and sustainability:

- Day-Farnsworth et al. (2009) conducted case studies of eleven organizations experimenting with new approaches to mid-scale distribution with an emphasis on “scaling up”—i.e., an expansion from direct market to wholesale transactions. The authors primarily focus on aggregation, as product consolidation allows supply chain partners to achieve economies of scale while ideally meeting local demand, maintaining fair prices for producers, and retaining environmental or social values.
- Innovations present in mainstream distribution may also be scalable. Cross-docking (a quick turnaround of product at an aggregation point) and backhauling (hauling goods on return trips) are two strategies that are growing along mainstream supply chains. The 2007 Food Industry Logistics Report also notes that the majority of survey respondents use bar-coded pallet tags to manage inventory; they are also using RFID methods with increasing frequency (Saddle Creek Corporation, 2007).

Aggregation and intermediated supply chains are growing research areas:

- King et al. (2010) highlight the intermediated supply chain—along which product is moved by an intermediary, rather than the producer or actors along a mainstream supply chain—which corresponds to the second tier of a framework laid out by the University of Wisconsin-Madison Center for Integrated Agricultural Systems, called the Tiers of the Food System (2010). Each study highlights partnerships that are tactically built with the goal of getting local food into particular markets, while sharing the profits and risks associated with building a supply chain.
- Dickie (2010) also emphasizes the need to focus on mid-level aggregation and distribution in order to create a robust local food system.

Food hubs are a growing research area that is specifically focusing on supply chain strategy:

- Bragg and Barham (2010) explore the concept of food hubs, where goals range from traditional market-oriented objectives (e.g., profit maximization) to facilitation of localized food systems that support environmental, social, and economic sustainability. In particular, food hubs also often offer additional services such as processing, facilitation of information flows between producers and buyers, or facilitation of consumer purchasing using WIC or SNAP benefits (Morley, Morgan & Morgan, 2008).
- The food hub framework and mapping can serve as reference points within transportation networks, providing insight into new, more efficient local food distribution channels.

Much of the reviewed literature suggests that regional food systems offer the greatest potential in balancing economic, environmental, and social goals.

- In King et al. (2010), the intermediated supply chain (distribution ranges from 13-300 miles) offers great opportunities in terms of social benefits, fuel efficiency, and percentage of retail price retained by the producer.

- The case studies in Day-Farnsworth et al. (2009) represent strategic methods for marketing local food beyond direct market methods, in order to reach a wider consumer base and realize other environmental, social, and economic benefits.
- Using weighted average source distances (WASD)—which combines information on distance traveled relative to the volume of food product being transported—Pirog and Benjamin (2003) found that, for Iowa, products sourced from within the state had substantially lower WASDs than products sourced nationally, meaning their transport was more fuel efficient.
- Lewis (1996) encourages planners, policy-makers, and allied professionals to think regionally when designing policy that affects humans' relationship with natural resources. In his book, *Tomorrow By Design*, Lewis defines the Circle City region of the upper Midwest. The region includes parts of Illinois, Iowa, Minnesota, and Wisconsin and was derived from the patterns of population concentration in the upper Midwest. The circle's edge has higher population density whereas the center is sparsely populated and offers a wealth of natural resources. This region has been used by Bower, Doetch, and Miller (2008) for their study on scaling-up the Upper Midwestern food system.

The key themes found in the current literature—challenges, strategies, aggregation, and intermediated supply chains, food hubs, and regional scales—illustrate the obstacles local food supply chains face, ways in which local food systems are working to overcome these challenges, and strategic trends that are emerging to create efficiencies along the local food supply chain. The existing literature suggests that the local food supply chain is a dynamic link on the path from farm to fork, and that emergent solutions will take a variety of forms. Solutions can be homegrown and entrepreneurial, emerging out of necessity and opportunity, or they may be tools borrowed from mainstream supply chains, such as RFID tagging and backhauling.

While local food supply chain research is becoming more widespread and is emerging from all sorts of places—academia, governmental agencies, and industry—there is still a lack of research that specifically looks at the actual hauling of local goods. Who is hauling (producers, distributors, hauling companies, etc.), how they are hauling (with owned vehicles, leased vehicles, by other modes, etc.), and the path on which they are hauling (farm to store, farm to warehouse to store, farm to wholesaler to warehouse to store, etc.) are examples of additionally relevant questions that must be answered when attempting to gain maximum efficiency along the supply chain.

Our study focuses on the Circle City region, which extends from the Twin Cities southeast across Wisconsin to the Chicago metro area. Case study participants were selected to represent different scales and different products in order to identify the widest possible range of logistical needs and innovations in local and regional food supply chains. We initially concentrated on three products—apples, potatoes, and beef—because 1) they are produced in relatively large volumes in our region, 2) they are represented in various scales of local and regional supply chains, and 3) because they each present different distribution challenges due to distinct harvesting, storage, and processing requirements.

Case Studies: Varying Scales of Local Food Distribution

To better articulate the nuances present in the distribution of local food, we conducted numerous case studies with different businesses in our region that are involved in the distribution of local foods. The businesses we interviewed represent very different scales of distribution, which helps answer how and what types of barriers and opportunities are related to scale. Another purpose of the case studies is to provide a current snapshot of how decisions are being made with regard to distribution. We also attempted to use the case studies to articulate what constraints affect the logistical challenges faced by these companies, as well as whether there are particular variables in the “distribution equation” that need to be optimized in order to increase the efficiency of local food distribution. Some of the conclusions we reached reinforced challenges articulated by Day-Farnsworth et al. (2009), while others shed new light on the distribution and logistics of local food systems.

Case Study: Ecker’s Apple Farm

Business Facts

Location	Trempealeau, Wisconsin.
Business structure	Business started as sole proprietorship in 1972; orchard started in 1945; family-owned business.
Business size	30 part-time employees in peak season and 2 year-round employees. Annual tonnage of product grown and moved fluctuates—it was 70 tons in 2010 and 350 tons in 2009.
Percent local products	About 90 percent of products distributed are from local sources.
Products distributed	Apples (primary), caramel, prepared caramel apples, and pies. Also sell some jams, packaged soups, and other similar products at roadside stand.
Customers	In order from largest to smallest share: direct sales from farm, wholesale accounts, farm-to-school programs, and farmers’ markets.
Distribution radius	For direct apple sales, Madison is farthest sales point at 130 miles away. Ecker’s does not track the distribution range of apples sold to wholesalers, though it extends farther than 130 miles. It sells its caramel nationally and ships orders through UPS.

Freight, Distribution, and Logistics

Ecker’s Apple Farm distributes and stores most of its products on its own. The farm owns a one-ton pickup truck and two sport utility vehicles for their distribution. During peak season, it also rents one refrigerated freight trailer (for apples) and one freezer freight trailer (for pies), which sit on the property until full. Once at capacity, Ecker’s hires a local trucking company to pick up the trailer and deliver it to the wholesale buyer(s). The trucking company backhauls from the wholesaler, bringing back Ecker’s containers that were at the wholesaler. It is an individual

contract with the carrier and there is no aggregation of its apples with other local products until it reaches the wholesaler.

For smaller deliveries and farmers' markets, Ecker's transports product with its own vehicles on a mostly ad hoc basis. For its three farm-to-school accounts, however, it does have weekly deliveries from August through November. For one school district, it brings apples to a central distribution point, and for the two others, it delivers them directly to the schools. This structure offers Ecker's flexibility and personal contact with its accounts. It is able to accommodate specific product requests, such as smaller apples packed together for elementary schools.

Due to its smaller size, Ecker's does not use computerized logistics systems. It currently uses a tri-copy paper system to track its orders, sales, and distribution. If feasible in the future, it would like to employ barcode system that can be read by smartphones in order to streamline this process, though this adoption is only in the discussion phase and would not happen for some time.

Challenges

One challenge resulting from Ecker's wholesale relationships is the retention of its brand along the supply chain. When Ecker's sells its apples to the two wholesalers they work with, its Ecker's Apple Farm brand disappears, as its product is aggregated with other apples. One wholesaler does, however, group all apples grown in that region together, under a specific brand, so the location origination information is somewhat preserved.

Another challenge Ecker's faces is the reconciliation of storage and the seasonality of apple crops. Renting or building more permanent storage is not necessarily financially efficient, as the farm would not need it for much of the year. During peak season, it could use additional cold and frozen storage for apples and pies, respectively. Currently it is filling this gap through the usage of trailers as on-demand storage. Also, certain apple varieties have different temperature requirements than others, so the farm needs to pay particular attention to storage temperatures. This keeps Ecker's from sharing storage with other producers, as it needs to have control over storage temperature.

While employing additional or more advanced technology would be useful for Ecker's, the up-front costs might be prohibitive to their adoption. Particularly, an electronic bar-coded system would be beneficial for inventory and tracking purposes.

Ecker's has found it challenging to know with whom and when it can combine deliveries to become more efficient through increased load size. For instance, Ecker's cited an experience where it had been delivering to the Producers & Buyers Co-op in Eau Claire, Wisconsin, only to find out that the co-op could pick up product from Ecker's on a combined pick-up route.

Though also a benefit to the company, another challenge resulting from Ecker's distribution structure comes from its delivery flexibility. Since Ecker's is solely responsible for getting its product to market, one employee needs to be able to deliver product fairly quickly, though all employees have other responsibilities. To some extent, this means that the customers' delivery requests take precedence over other priorities and responsibilities.

Lessons

Ecker's small size offers it a great deal of flexibility with its accounts. It can customize orders for its farm-to-school accounts, as well as deliver products on an ad hoc basis, though this can also become expensive. Further, there are social benefits offered from its small size. Specifically, the owners are able to spend time with the students at the schools where they have farm-to-school accounts, fulfilling the reciprocal aspect of farm-to-school relationships.

Use of low-cost, low-tech storage infrastructure enables Ecker's to address seasonal fluctuations in supply without making a costly investment in a permanent temperature-controlled storage unit. Ecker's is an example of a farm that is scaling-up by using creative solutions that are driven by necessity. Specifically, its use of freight containers as temporary storage is innovative. It solves its need for additional storage in the fall, while also simplifying the transportation aspect of the delivery. In the off-season, it does not need to maintain or pay for storage.

Direct sales help ensure that the company retains a higher percentage of the retail price. This is why Ecker's tries to sell as much as possible via its direct markets (on-farm and farmers markets), though it has too much product to move it all this way, at which point it sells to wholesalers. While profitable, this arrangement does require time and flexibility on behalf of the owners.

Case Study: Grass Run Farms

Business Facts

Location	Spring Grove, Minnesota (office and warehouse) and Dorchester, Iowa (Jepsen's farm).
Business structure	Formally incorporated in 2009 as an S corporation; owned by four shareholders, all of whom are beef producers for the brand.
Business size	4 full-time employees; \$1.5 million in sales in 2010, expected \$2.5 million in 2011.
Percent local products	100 percent.
Products distributed	Grass-fed beef, natural grain-finished beef, and "fresh air" pork—all raised without steroids, antibiotics, or growth hormones.
Customers	Co-operative grocery stores, universities and colleges, and restaurants; looking into working with smaller and specialty distributors or broad-line distributors.
Distribution radius	Outward to Des Moines, Iowa; Minneapolis/St. Paul, Minnesota; Milwaukee, Wisconsin; and Chicago, Illinois.

Freight, Distribution, and Logistics

Grass Run Farms (GRF) does not own any of their own refrigerated delivery trucks, but contracts with Twin Cities-based Edina Couriers. Once per week Edina stops at GRF's warehouse to pick up product. It delivers the product purchased by Twin Cities co-ops directly to the Co-op Partners Warehouse in St. Paul, Minnesota, but drops the restaurant orders off directly at the restaurants. Also weekly, Edina goes to Spring Grove and then brings GRF product to cities in Iowa, including Decorah and Des Moines. Originally, GRF owned their own delivery trucks; however, they found that due to their smaller volumes, running routes was inefficient, so they entered into a contract relationship with Edina Couriers. Due to this contracted relationship, GRF is not in a position to schedule backhauls.

In terms of technology, GRF is implementing an electronic scanning inventory system at its warehouse in order to increase efficiency, accuracy, and profitability. They can scan product as it comes in from the slaughterhouse and then the inventory data is available online where buyers can place their orders. From these orders, a packing slip is created and then as the order leaves the warehouse, it is scanned, which triggers the creation of an invoice, as well as the inventory removal from the website.

Challenges

One particular challenge cited by GRF is that of creating partnerships to take advantage of distribution efficiencies. Specifically, GRF has considered working with a distributor, but that distributor would need to be in line with the vision and values of GRF. For GRF, the relationship needs to be strategically built around more than just profit, as their product is different than commodity beef and their company holds specific values that need to be reflected in the product marketing. Giving another company control over GRF's product representation is challenging, as trust needs to be built first.

Similarly, GRF first needs to establish trust if they were to partner with other producers and aggregate product. A primary reason for this is competition. Each partner needs to be assured that the other businesses will not try to push them out of the market. At the same time, however, there are also concerns with establishing cooperative arrangements. Not only can the decision-making processes be slow in cooperatives, GRF also wants to partner with a business that can provide distribution expertise where GRF either cannot focus or prefers to focus on other areas of expertise. Partnering with other producers that are in similar positions to GRF means that they would all need to learn and experiment together, which takes significant time and money. GRF wants to remain a for-profit business, but work cooperatively with other producers in order to achieve an efficient distribution of their product.

Lessons

Partnerships allow businesses to capitalize on their strengths. For the producers of Grass Run Farms, working together allows for more efficient distribution (through higher volumes). It then allows them to capitalize on their individual strengths. Some of the owners are best at producing beef, others at selling and marketing, or administrative tasks. Working together enables all of them benefit from these skills, making the business more resilient. Establishing partnerships outside of their business, though, is more challenging, as GRF needs to retain their product identity, market share, and ability to make quick business decisions.

Trust between supply chain partners is invaluable, as is working with experienced supply chain partners. If product is going to be aggregated, building trust among supply chain partners is paramount. Knowing that your product will be represented well and that various partners will not try to take over each other's market shares is invaluable to the farmers. If these differences can be successfully worked out, there could be potential in increased coordination and aggregation with other producers. At the same time, however, producers are seeking partners that can offer some expertise that they do not have themselves, such as with distribution or logistics. Going through the slow process of learning those things together, such as in a cooperative arrangement, may be prohibitive in its time and monetary costs.

Case Study: Driftless Organics

Business Facts

Location	Soldiers Grove, Wisconsin.
Business structure	Limited liability corporation (LLC).
Business size	3-4 year-round employees, 15-20 at the height of the season; 2010 revenue at \$500,000.
Percent local products	100 percent.
Products distributed	Wide variety of vegetables, though potatoes are its staple wholesale crop. Also sells sunflower oil.
Customers	CSA members, retailers, wholesalers, restaurants, farmers' markets, and farm-to-school programs.
Distribution radius	Through a wholesaler, all of Wisconsin, Minnesota, and Michigan's Upper Peninsula.

Freight, Distribution and Logistics

Driftless Organics owns one 16-foot refrigerated truck and one cargo van, and they often share product runs with neighboring Star Valley Flowers, which has a 20-foot refrigerated truck. Together, these two farms have a weekly run to Chicago and one to the Twin Cities, which occur on different days. This means that on any day there is an extra truck, which operates as a safety net for both farms, in case a vehicle has maintenance issues, for example. Further, since the trucks are different sizes, this affords the farms a bit of flexibility on load size.

Driftless Organics employs one driver for its vehicle, who also serves as a spokesperson for the Driftless Organics brand. One of the owners of Driftless Organics worked as the driver for a number of years, but a few years ago it became difficult to justify his driving time when he could be of better use on the farm. Finding a driver that could also act as an effective spokesperson for the brand was imperative to the owner when relinquishing the driving duties.

For the products that Driftless Organics sells through Co-op Partners Warehouse (CPW), it partners with another nearby farm, Harmony Valley, which acts as an informal food hub (i.e., aggregation and distribution center). Edina Couriers picks up products at Harmony Valley and brings them to CPW in St. Paul, Minnesota. Driftless Organics also brings products to Harmony Valley that it sells to Whole Foods Market. When Whole Foods is making a run from the Twin Cities to Munster, Indiana, it picks up products at Harmony Valley.

Harmony Valley has become an informal point of aggregation for its own products as well as those of Driftless Organics, Star Valley Farms, and several other small, local farms. Harmony Valley has taken on an aggregation function primarily because it already had the necessary storage capacity and equipment (e.g., fork lifts, two docks, and coolers). It is not in close proximity to primary transportation routes, however, making it a less than optimal hub site.

Currently, Driftless Organics does not utilize any logistics or inventory technology. When planning its routes, the staff uses a combination of Google Maps and local knowledge to run what seems like the most efficient route. Its staff is curious about how route-planning software

would change its routes, which at the present are based on a variety of factors, some of which may not closely align with route optimization software designed for higher volume, more conventional haulers.

Challenges

Ideally, all trucks would be full when moving, and Driftless Organics would like to backhaul more. It is challenging, however, to always have product to pick up. If there were a food hub in Madison or Viroqua, Wisconsin, for example, this would increase the chances that product or reusable containers could be backhauled. Building a network through which to haul would help Driftless Organics streamline its deliveries.

Building these networks, however, comes with its own set of challenges. Not only are such networks difficult to establish, Driftless Organics would also be concerned about its products' representation along the supply chain. Since the delivery driver becomes the face of the products it hauls, Driftless Organics would want to know that the driver is able to adequately represent the farms and the value-added products it hauls.

Driftless Organics stores its products in several facilities that are scattered throughout its production area (Driftless Organics leases several different production sites). This complicates its logistics and raises tough questions about the actual costs of distribution and storage, which makes it more challenging to know when it should contract out these services. Driftless Organics notes that it experiences built-in inefficiencies due to its small size and decentralized nature, revealing a relationship between land tenure and inefficiencies in aggregation and transportation.

Lessons

Strategic supply chain partnerships increase distribution efficiency and market access. Driftless Organics is able to streamline its distribution through its relationships with nearby farms and supply chain partners—Harmony Valley Farm, Star Valley Farms, Edina Couriers, and Co-op Partners Warehouse. They meet a few times per year to discuss trucking, distribution, and ideas for how to make their deliveries more efficient. Without these strategic partnerships, Driftless Organics would not be able to consolidate deliveries and its market would be constrained to what it could access efficiently on its own.

Regional volumes are large enough to warrant partnerships for CSA deliveries, though the requirements of individual business accounts might present a logistical challenge. According to Josh Engel of Driftless Organics, there is sufficient volume for a business to orchestrate CSA deliveries for multiple farms to places such as Madison and the Twin Cities. The question is whether cumulatively the logistical inefficiencies characteristic of CSA and restaurant accounts would make such an operation too costly to operate. Each farm has very specific stops, which may make it challenging for a single business to take over for all the individual farms. While the volume may be adequate, the logistics might prove challenging.

Understanding costs of distribution are necessary for businesses to improve their distribution efficiency. Having a proper understanding of the cost of distribution is a critical component to creating partnerships and contracting delivery services. Driftless Organics' ability to pinpoint costs and savings under different delivery scenarios helps it make sound business decisions. It helps Driftless Organics in establishing beneficial relationships with other supply chain partners, as its staff knows where high or low costs are incurred, and where and how it might be able to find greater efficiencies.

Case Study: Keewaydin Organics

Business Facts

Location	Viola and Viroqua, Wisconsin.
Business structure	Distribution business (Keewaydin Organics) is a limited liability corporation (LLC); family farm (Keewaydin Farms) is a sole proprietorship.
Business size	On farm, 3 full-time and 2 part-time employees, \$100,000 in business in 2010; distribution business has 3 full-time and 2 part-time employees, \$500,000 in business in 2010.
Percent local products	100 percent.
Products distributed	Approximately 150 different fruits and vegetables.
Customers	60 percent co-operative groceries, 20 percent conventional groceries, 10 percent restaurants, 8 percent wholesalers, and 2 percent school systems.
Distribution radius	Minneapolis, Minnesota to Chicago, Illinois, including Madison and Milwaukee, Wisconsin; 95 percent of sales are in urban markets.

Freight, Distribution, and Logistics

Keewaydin Organics owns a six-pallet truck, a sixteen-pallet trailer and a van, all of which are refrigerated. When planning its routes, Keewaydin uses Google Maps to create the visual of its delivery sites, and using the maps and personal knowledge of the region it devises what appear to be the most efficient routes. Currently, Keewaydin does not have the staff capacity to seek out opportunities for and to plan backhauls.

During the slow season, Keewaydin makes weekly deliveries to each of its urban markets—Minneapolis, Chicago, Milwaukee, and Madison. During peak season it has at least two delivery cycles per week. It makes its own deliveries to Milwaukee and Madison, and Edina Couriers hauls its product to Minneapolis and Chicago. Keewaydin also works with other distributors and haulers in order to fill-out its loads, which it has been doing since 2010. Some loads are run by Nottestad Trucking, which contracts with Organic Valley and lets Keewaydin piggyback on its deliveries. Ideally, Keewaydin would ship products six days per week by piggybacking on other deliveries, such as these.

Previously, Keewaydin took care of all of its own hauling, but it proved to be too expensive and so it now uses haulers. It is challenging, however, to find haulers willing to make a lot of small stops, which is currently a necessity due to the nature of Keewaydin's customer base. Owner Rufus Hauke's ideal hauling system would utilize smaller trucks for aggregating product and delivering it to a regional hub and larger trucks (53-footers) for interstate hauls. Once in an urban or peri-urban market, the product would be cross-docked and hauled by smaller trucks to CSA drop-off points, restaurants, and retail accounts.

While it currently does not use any computerized logistical tools, Keewaydin is working with a local private software consultant on the development of a computerized database system to

better manage its inventory and ultimately better match supply and demand. This software and database would provide customers with real-time inventory. Currently, Keewaydin is working with 40-60 producers. Since the system stores purchasing history, it can be used to approximate the volumes of product that producers can sell, which helps them plan their production volumes. The software is still being piloted, though, and the purchasing history element is still being worked out, as there are other variables to account for, such as weather patterns and general increases in business.

Challenges

One challenge Keewaydin faces when making its own deliveries is interstate trucking regulations. Maintaining compliance is challenging, even within the three states in which Keewaydin ships its products. This is another reason why hiring professional haulers and couriers is preferred. Since these companies solely deal with trucking and shipping, they are fully aware of and in compliance with interstate trucking regulations. When Keewaydin encountered problems with their trucks, not only were the resulting citations expensive, it also affected that day's delivery schedule, which in turn affected its relationship with its customers.

Another challenge Keewaydin encounters is preserving interpersonal contact and brand identity with business when utilizing haulers. When Keewaydin's products are shipped via courier or hauler, it is losing valuable face-time with its customers. Haulers and couriers do not represent the product out in the field. Currently, Hauke is able to maintain himself as the face of the business by doing in-store demonstrations, traveling weekly to visit with buyers, and having paid staff dedicated to making phone calls to customers.

Lessons

Communication is key to matching supply and demand. Keewaydin has an in-house sales person for 2011, which will improve its communication with its customers. Also, using the software system should allow Keewaydin to better communicate to customers, offering them real-time inventory, and offering Keewaydin easy access to information about purchasing history, which it can use to plan production volumes.

There is opportunity to coordinate between different farms and businesses. Such coordination could increase product volume, allow for more efficient deliveries, and allow growers to access customers that were previously out of reach. Hauke speaks frequently of the potential of a cross-docking and aggregation facility to increase efficiencies and market opportunities through additional services such as light processing. Such an effort will first require trust between the different partners. Once this trust is established, the partners can then define a mutually beneficial vision of the services they want to coordinate. Additionally, these types of collaborations are more likely to thrive if there is a staff person, either at one of the businesses or hired by the group, to act as the coordinator.

Case Study: Local Harvest Supply

Business Facts

Location	Coralville, Iowa.
Business structure	Set up as a limited liability corporation (LLC); parent company is Hawkeye Foodservice Distribution Co.
Business size	3 employees; 2010 first year sales over \$100,000, expected to be over \$500,000 in 2011.
Percent local products	100 percent.
Products distributed	Produce, free-range eggs, free-range chicken; adding dairy and additional proteins in 2011.
Customers	Restaurants, universities and colleges, school systems, healthcare facilities, some grocery stores, though primarily institutional sales.
Distribution radius	Distribute within Iowa, as well as to Minnesota, Missouri, and Illinois primarily. Deliveries stretch through 12 states in total.

Freight, Distribution, and Logistics

Local Harvest Supply (LHS) works closely with its parent company, Hawkeye Foodservice Distribution (HFD) to distribute its products. HFD is an established foodservice distributor that employs Pryia inventory devices, which interface with its Food Distribute software to manage inventory. HFD also uses Roadnet fleet management software to plan routes for its fleet of over 50 semi tractor trailers. LHS orders are grouped with customer orders from HFD so that products from both companies arrive in one shipment.

To pick up product, LHS usually goes to the farms from which it purchases product, though some farmers that are either nearby or have refrigerated trucks bring their product to the LHS warehouse. For this aspect of its procurement, LHS has one refrigerated truck and groups routes when possible. LHS attempts to deliver using a consistent weekly schedule, though it employs elementary planning methods and it does not utilize route-planning software. However, LHS does use Evant purchasing software, which helps the company understand and orchestrate ordering and purchasing patterns, thus helping to balance supply and demand.

Challenges

One of LHS's biggest challenges is related to scaling-up its suppliers. In order for LHS to have enough supply, it will either need to source from more farms or the farmers it works with must increase their production and invest in better on-site washing, packing, and storage infrastructure. Further, there are challenges in communicating with farmers, as many of them are still learning basic business practices. For example, invoicing processes and regular communication of inventory updates are new to many of the farmers, and for LHS it can be challenging to teach all the farmers standardized practices. This year, however, it has developed set of guidelines that it gives to all its growers, which has helped with the standardization of invoicing and inventory practices.

Another challenge is creating more efficient pick-up routes. Establishment of more efficient pick-up routes would allow LHS to benefit from economies of scale, as well as and cut down on fuel consumption, which will only become more of a cost as fuel prices increase.

Lessons

By forming partnerships that span different supply chain scales, there is potential for more efficient and wider distribution of local products. The close relationship between LHS and HFD suggests that there is great potential for partnerships between local food suppliers and larger, more mainstream distributors. Here, LHS piggybacks on deliveries already going out from HFD making it easier for institutions to integrate local products into their offerings, as well as saving on fuel costs and emissions. LHS also benefits from HFD’s already existing distribution and logistics systems and expertise. At the same time, however, the smaller size of LHS allows them to develop relationships with farmers that HFD might not be able to cultivate on its own. This reciprocal relationship opens up new opportunities for both businesses, and helps market local products to channels that might not otherwise be accessible to local producers.

Product origination information can be retained along a mainstream supply chain. Another benefit of the relationship between LHS and HFD is its ability to retain information about products’ origin along a relatively conventional supply chain—a feat that is much more challenging as the size of a distributor increases. When product arrives at the LHS warehouse, the boxes are labeled with the product origination information. Ultimately, products arriving at institutions via HFD deliveries have the farm name, harvest date, and production location listed on the case of product.

Case Study: Bix Produce

Business Facts

Location	St. Paul, Minnesota.
Business structure	Limited liability corporation (LLC).
Business size	270 employees; move 68 million pounds of produce annually.
Percent local products	8 percent.
Products distributed	Fresh fruits and vegetables (whole and processed), nuts, dry beans, spices, dairy—general foodservice distributor.
Customers	Institutions, restaurants, a few broad-line distributors.
Distribution radius	All of Minnesota, western Wisconsin, eastern North Dakota, and northern Iowa.

Freight, Distribution, and Logistics

Bix Produce has 54 trucks in its fleet—2 semi-trailer trucks, 8 sprinter vans, and 44 straight trucks, ranging from 18-24 feet long. All of its trucks are refrigerated. Bix has more than 1,500 customers, which is a source of strength because working in high volumes allows it to reliably bring in large volumes of product one day and send it out the next—guaranteeing product freshness. Further, its size creates a robust delivery network, allowing it to more easily

accommodate new customers. Local producers are responsible for bringing their product to Bix's warehouse and producers usually turn around orders in one to two days. Generally, Bix does not experience challenges in distributing local products.

From its warehouse, Bix sends out 27 to 34 trucks per day. It uses a UPS Logistics Technologies system in combination with its own routing system to develop strategic routes that allow it to optimize its hauling. Bix's own routing system is electronic and uses an intuitive schematic. These routes are fixed, but Bix uses the UPS logistics system to fine-tune and adapt the routes according to that day's load size and specific delivery locations. Bix backhauls when possible, but since it is a regional distributor, it usually does not have much to backhaul from the delivery locations.

Inside the warehouse, Bix uses a mix of manual and electronic systems. It uses a manual order-pick system and is in the process of adding a management system where everything is scanned on its way in or out. This system will increase product traceability along the supply chain, as well as contribute to a quick and organized response in the event of a product recall. Bix anticipates that this new system will work well with its larger growers from the western United States, but that it will be a more challenging adaptation for its local growers.

Challenges

One of the greatest challenges Bix faces with regard to its local product sourcing is the unpredictability of the weather. If it plans on getting a certain product from local suppliers for, say, all of July and August, then if something happens to that crop, or a weather event occurs, then Bix needs to source from elsewhere. In the even shorter term, if a farmer has to delay a harvest for one day due to rain, then Bix might need to find some of that product quickly for the next day's deliveries. Since it does not already have it on the road from California, it needs to make last minute purchases from other distributors or wholesalers in the area, which can be challenging and expensive.

In expanding its local food procurement and distribution, Bix's primary challenge is insufficient demand. Bix works to educate its customers on how to integrate seasonal and other new products into their menus. This is a necessary aspect to increasing customer demand for a variety of local products.

The biggest constraint Bix faces with route planning is time—many of its customers want just-in-time inventory so that their products are as fresh as possible and storage needs are minimized. While Bix cannot fully accommodate these requests, it does use its routing systems to accommodate these requests as much as possible.

Lessons

Reciprocal relationships between suppliers and distributors ease other challenges faced by distributors of local product. Bix works hard to maintain and foster its ongoing relationships with its various local growers. These relationships are strategic in that they work together to overcome obstacles to getting local products to market. Bix has helped its growers evolve and increase volumes appropriately. It also works to provide educational opportunities for its growers to help them understand various regulations or markets. These producers work hard to grow the volumes and products that Bix wants, and in turn, Bix is committed to long-term relationships with these growers. These reciprocal relationships contribute to Bix's general feeling that it does not face challenges specific to its local food logistics and distribution. This suggests that distributing local product might be easier for companies of Bix's scale and when local products are a smaller percentage of total products sold.

Reciprocal relationships between suppliers and distributors also increase local product integration, visibility, and saturation. By establishing relationships such as these, Bix is able to effectively integrate local products into its lines. When certain products are in season, Bix only sources them from local suppliers. For example, when green peppers are in season, Bix can locally obtain the volume needed to solely sell local green peppers, rather than offering Californian product and local product side by side. This increases the visibility and saturation of local products. Each week Bix supplies its customers with a list of the farms it is sourcing from, which allows the customers to promote those farms whose products they are selling. As supplies increase in size, it becomes more difficult for Bix to retain information about product origin. As a result, Bix offers an appropriate compromise for a company of its size: it distributes weekly sales sheets that indicate which products were sourced from which farms. While its customers do not necessarily know exactly which farm the products came from, they do know that all of the green peppers, for example, sold that week came from farms A, B, and C. This allows customers to generally know where their products come from, but does not over-burden Bix with the need to retain origination information for each case of product, which can be challenging in a warehouse environment where local product is often aggregated to meet purchasing volumes.

Case Study: Edina Couriers

Business Facts

Location	Eden Prairie, Minnesota.
Business structure	Limited liability corporation (LLC).
Business size	\$6 million in combined revenues for 2010; 13 full-time employees, 1-4 temporary employees.
Percent local products	15-18 percent of annual revenue.
Products distributed	General commodity carrier; entered refrigerated freight marketplace 4-5 years ago.
Customers	In food division, distributors are its primary customer.
Distribution radius	All of Minnesota, Wisconsin, most of Iowa, and the Upper Peninsula of Michigan.

Freight, Distribution and Logistics

All of the trucks and drivers used by Edina Couriers are independent contractors, though they are all “permanently contracted”—meaning the drivers are self-employed, but retain a level of job security—and have Edina’s logo and licensing numbers on their vehicles. For what it calls its “over-the-road” refrigerated division, it contracts with eleven 24-foot dock-high trucks, four of which are refrigerated; and it has three semi-trailer trucks and four trailers (at all times, one trailer is not in use), three of which are refrigerated. For its local non-refrigerated courier service, it contracts out 50-plus vehicles.

In terms of routing, as a contracted service, Edina sends out trucks as requested by its customers. One of Edina’s principle customers’ deliveries define much of Edina’s delivery

footprint. Edina uses these deliveries as a core that it can build other deliveries and backhauls onto. Basically, the principle customer sets the routes and Edina works around those routes to add freight to fill empty volumes and make deliveries more efficient. Edina prices its deliveries as outbound movements, but if it can establish more regular backhauling—which is challenging—it can bring down prices on outbound movements.

Edina strives to deliver products at the stated time, in order to help facilitate subsequent distribution. For example, it might deliver something to a drop point in Milwaukee, where it is quickly picked up by another distributor to be brought to a specialty restaurant. It makes a great deal of effort to arrive at specific delivery times and it has a high on-time percentage (98 percent).

In terms of electronic technologies, Edina operates CXT software, which works in conjunction with MC55s and GPS technology that gives thirty-second updates about the location of the trucks. Edina is able to know where any truck is at a given moment. It also uses scanning devices and separate warehouse software to record all movement in and out of the warehouse. This allows customers to be able to access their inventory instantaneously.

Edina picks up all products that it delivers directly from its suppliers. For food, one of the primary reasons for this is that it lacks on-site refrigerated warehouse space that can accommodate food products.

Challenges

Edina encounters challenges related to its limited capacities, which hinder its ability to expand its distribution of local foods. Specifically, Edina could benefit from access to cold and frozen warehouse space at various points within its distribution range. At these facilities, products could be aggregated or consolidated and better integrated into delivery routes.

Another challenge Edina faces is communicating effectively with producers about their costs of distribution. Edina has approached producers about contracting Edina's delivery services, but producers often do not know how to calculate their current costs of distribution and therefore find Edina's services too costly. Edina has done some calculations, though, and strongly believes that it could often bring cost efficiency to many small and mid-scale producers who are currently running their own deliveries.

Like many local foods distributors, Edina finds regularly scheduling backhauls to be challenging. Currently, it adds them when possible—for example, it picks up dairy products in Wisconsin when returning to Minnesota from Milwaukee. Edina's management realizes, however, that there is a lot of opportunity in integrating regular backhauls, and wants to formalize this aspect of Edina's operations. Ideally, this will be possible if Edina creates a separate division or subsidiary, which it is considering, and which would specifically work on the distribution of local and regional foods.

Seasonality poses another challenge to Edina. They find difficulty in designing a service for customers that only have products at certain times of the year. Further, the volumes of these products are not consistent, even within the growing season. This is an issue that Edina could better address if it creates a new, specialized division or subsidiary.

Lessons

Hauling services can offer producers increased distribution efficiency, though producers first need to become more knowledgeable about their costs of distribution. There is great potential for haulers, such as Edina, that contract with producers to transition them away from self-distribution and into more efficient local and regional “intermediated” supply chains. Greater

efficiencies can be found when these services are run by experts, who can aggregate and haul various products from numerous suppliers and distributors. Edina is in a unique position to offer this service to many producers in our study region; however, before it signs on more producers, producers will need to become more knowledgeable about their current costs of distribution. Edina is currently assessing the feasibility of expanding into this market, though it first needs to make sure that there is sufficient demand to warrant such expansion.

Haulers can bring some of the efficiencies of mainstream supply chains to smaller farms, while still allowing the farm businesses to retain values-based attributes. Edina’s enthusiasm for developing a division devoted to local distribution and partnering deliberately with a wider range of local suppliers illustrates the potential of these partnerships. Combining producers’ desires to scale up their local food production with Edina’s willingness to work with them to identify solutions to distribution bottlenecks, demonstrates the potential of a well-intermediated supply chain. In such a scenario, the supply chain partners can take advantage of some of the benefits usually experienced in conventional supply chains, such as economies of scale, while retaining some of the core values-based attributes crucial to the businesses’ goals for a fairer, more sustainable food system. In fact, these values help maintain the relationships needed to run these supply chains.

Case Study: Sodexo

Business Facts

Location	Gaithersburg, Maryland (US Corporate Headquarters).
Business structure	Public corporation.
Business size	120,000 employees, \$9.5 billion in revenue (2010).
Percent local products	Within its foodservice division, on average nationally, 9 percent of fresh food is sourced locally, though it varies across the country—around 25 percent in Washington, DC, 20-25 percent in Minnesota, but less than 10 percent in Texas due to low product diversity.
Products distributed	Sodexo is a full service foodservice provider and it contracts with different distributors in each region of the country.
Customers	Institutions (universities and colleges, K-12 schools, hospitals, senior facilities, government facilities, etc.).
Distribution radius	The distributors that Sodexo uses are all regional, and their distribution radii are all likely less than 500 miles.

Freight, Distribution and Logistics

By 2008 Sodexo had switched from a national distributor model to a regional one, which has greatly contributed to Sodexo’s ability to source more product locally. Sodexo has found that regional distributors not only generally have a greater commitment to sourcing locally, they are also better at documenting where their products come from. This information is important to Sodexo because it allows it to better document its progress on increasing its sourcing of local, seasonal, and sustainably grown food.

Sodexo sources all of its fresh food products through distributors. At times, farmers approach its kitchens and want to deliver product directly. Sodexo's staff, however, is not trained to inspect incoming product to ensure that particular handling practices were used prior to delivery, and it relies on distributors to vet products before they arrive at its kitchens. Further, Sodexo prefers not to source directly from farms because it has had some experiences with the farmers overextending themselves and having inconsistent quality or falling short on supply. Sodexo's business depends upon reliable suppliers.

In route planning, each distributor has a different process and many use computer-based systems. Sodexo works to reduce the frequency of deliveries, so that the distributor is able to reduce its delivery miles to limit environment impact and generate shared savings. For example, if a distributor already has a truck passing near a given kitchen's location, it will notify Sodexo, and if Sodexo can be flexible with delivery times, the distributor is able to reduce its delivery miles and delivery price.

Recognizing the potential to increase other hauling and material efficiencies, Sodexo has experimented with backhaul strategies and reusable totes for its products. Unfortunately, these experiments have not been successful for a variety of reasons, including: lack of durable totes, totes being used for different purposes, or product damage due to different order sizes, which can leave extra space in the totes, allowing for the product to shift and increasing its susceptibility to damage.

Sodexo was able to find existing regional distributors to work with in most regions of the United States. In rare instances, in which it was not able to find a good candidate to serve as its local distribution partner, it instead invested in a start-up regional distributor. The last time this occurred was more than four years ago in upstate New York. This is not Sodexo's preference, as it requires a different level of investment, so Sodexo reserves this approach for situations in which there is quality product, an obvious need, and a good potential business leader with a sound plan.

Challenges

Sodexo would ideally like to source high volumes of local product. It faces barriers in food service staff's limited ability in working with whole ingredients and the overall difficulty of integrating seasonal products into menus. Additionally, some customers are not interested in the types of products that are generally available locally. For instance, certain customers much prefer iceberg or romaine lettuce over locally available varieties or want a greater variety of fruits and vegetables than may be locally available throughout the year. Local producers need to offer more diversity of product and sufficient volume in order for Sodexo to increase its local sourcing. This will likely require a combination of market research to better understand the types of products different local market segments are seeking, as well as infrastructure to increase production capacity, extend the growing season and improve storage.

Sodexo faces other challenges because it is a guest at its clients' facilities. This means that while management is aware that different kitchen infrastructure—such as on-site processing and storage—would increase Sodexo's ability to source and process local food, it can be challenging to finance such improvements. Client institutions have their own investment priorities and Sodexo often works on short-term contracts that do not support these types of investment in the client facilities.

As with many large customers, finding sufficient product volume is also a challenge for Sodexo when it comes to local product. Generally, as a minimum volume, Sodexo needs to receive enough product to fill a menu slot for at least an 8-14 week period over the year.

Lessons

Institutional buyers see value in infrastructure and businesses that extend growing seasons and increase food-processing opportunities earlier along the supply chain. Due to the infeasibility of Sodexo altering kitchen infrastructure to increase processing, it sees potential for distributors to work with farmers on extending the growing season and processing local product, which would reduce the need for on-site preparation at institutional kitchens. Distributors will need to communicate these “downstream” challenges to the farmers, processors, and investors, in order to increase supply-chain wide investment in programs that increase local food production and distribution capacity.

Communicating all information to consumers about product origin is difficult for companies that work in as large of volumes as Sodexo, though compromises are possible. Sodexo receives regular updates from many of its distributors about where particular local products are from. This enables Sodexo to promote that producer or its practices on Sodexo’s menus, which it updates fairly frequently. Often Sodexo also uses this information to report to various client executives or authorities, such as a dean of students, a school board, or a corporate purchasing agent.

Conclusions from Case Studies

Together, these case studies provide insight into the distribution and logistics aspects of several local and regional food supply chains. Certain themes and challenges were consistently voiced by case study participants, demonstrating the pervasiveness and importance of those issues. Some of them reiterate challenges previously articulated by Day-Farnsworth et al. (2009), and others shed new light on distribution obstacles.

Generally, the array of challenges faced by these companies helps highlight the relationship between challenges and business scale. For example, Bix Produce is able to integrate local products into its existing deliveries, and feels that its challenge to selling more local product is related to increasing demand. On the other hand, Grass Run Farms feel they have sufficient demand for their products, but struggle to find economies of scale and more efficient distribution methods.

The particular themes and challenges illustrated by our case studies, and several potential solutions, are discussed below.

Product representation in the field versus efficient distribution

Producers working along direct and intermediated supply chains consistently expressed concern about how contracting or working with distributors could affect the valuable relationships that they have developed with their clientele. Specifically, some producers expressed either a perceived or real trade-off between the quality of product representation in the field and more efficient distribution.

For these producers—including Keewaydin Farms and Driftless Organics—they want to increase their distribution efficiency, but they feel that cutting down on some of the direct contact with buyers could ultimately hurt their businesses. Similarly, Grass Run Farms feel that they could achieve more efficient distribution if they partnered with other companies or distributors, but also do not want to harm their product brand by integrating their product lines with others, or not being the point-of-contact in the ordering process. As stated by one of the owners, who specializes in sales for Grass Run Farms, “no one knows our products better than me.” Ecker’s Apple Farm also perceives a benefit in its face-to-face contact with many of its customers.

Potential solutions to this trade-off:

- These business owners can accommodate this challenge by making separate contact with their buyers, either through in-person visits or phone calls. If not burdened with the delivery trucks, many of these owners and producers could make infrequent trips to customers' locations.
- If an aggregation facility was small enough, producers could educate drivers, as well as create informational sheets that could be given to the buyer along with their products.

There is a market for local haulers

Among producers who deliver their product along direct and intermediated supply chains, there exists a potential market for haulers specializing in carrying regional food. For many of these producers, inefficient distribution of their product is one of their main challenges. While some producers are willing and interested in making the trade-off of decreased face-time with their buyers for more efficient delivery, some also feel that continuing their own delivery is the best business decision. It is likely that some of these producers constitute a yet unrealized market for regional food haulers. As these markets are realized, the haulers can achieve higher volumes of product, better use practices such as back-hauling, and are more likely to take advantage of economies of scale.

Potential solutions to the realization of these markets:

- Through outreach and education (by co-operative extension services, for example), producers who currently haul some or all of their products learn how to calculate their own costs of distribution. Producers could learn how to create requests for proposals (RFPs) for hauling and distribution services. If producers understand their costs of distribution, including the appropriate valuation of the owner's time, they might be more amenable to quotes received from haulers.
- Haulers learn to market and design their services to this specific clientele. Producers may have specific needs, such as temperature control or flexibility of load size, which haulers could try to accommodate.
- Producers and haulers work together to create strategic partnerships that benefit both businesses.

Route planning strategies are related to scale

In speaking with different scales of distributors—from ones that distribute their own products, to ones that distribute larger volumes from many producers—it became clear to us that route planning strategies are related to scale. Many of the producers who distribute their own products simply use maps and local knowledge to develop “logical routes.” Essentially, using a map, they look at where they need to go by when, and create what seems to be the swiftest route. Some of these businesses deliver on more of an ad hoc basis, and some use weekly schedules to bring routine to their deliveries.

Distributors that haul larger volumes have more trucks and stops than the smaller distributors, and as such, they have more variables to consider in their route planning calculus. In order to navigate this additional complexity, many of the larger distributors use route planning software.

While route planning software is useful to larger distributors, it is questionable as to whether it would be useful to smaller operations, as they have fewer variables (trucks, routes, stops) to consider in their schematic. For the most part, the smaller businesses that we spoke with seemed satisfied with the route planning element of their distribution, and felt the larger challenges were found in the elements mentioned elsewhere in this report.

Backhauling is beneficial but challenging

Increasing backhauling opportunities is something that would be preferred by all of the businesses we interviewed. Backhauling simply refers to carrying a load on a truck's return trip. Some of the businesses interviewed are able to integrate backhauling into their delivery, such as with Ecker's Apple Farm, which is able to haul back their reusable containers after they deliver to wholesalers. Edina Couriers, the only exclusive hauler we interviewed, also spoke of regular backhauling as a way to decrease prices for outgoing delivery runs. If Edina were to get to a point where it could regularly backhaul, it could lower its prices for outgoing deliveries, which are currently based on the costs of delivery with no backhauling.

Most companies, though, spoke of the difficulty of arranging regular backhauls. Creating regular backhauls adds another level of complexity to the route planning process that is very difficult to integrate, even for companies that are using route planning software. Bix Produce noted that because it is a regional distributor, backhauls are very difficult to integrate, implying that even it is too small to effectively backhaul.

Potential solutions to increasing incidents of backhauling in regional food systems:

- Using online forums to create and facilitate a robust network of local food moving throughout the region. Regional haulers could use the national hauling network www.123loadboard.com as a model.
- With a more robust network of food freight movements, perhaps route planning software can more effectively integrate backhauls into its recommendations.
- Increased usage of reusable containers could aid in backhauling. While this strategy is effectively suggesting adding something in order to backhaul, the usage of reusable containers could save businesses money, and would provide environmental benefits by reducing disposable boxes. Businesses would likely, however, need to rent space in the warehouses that would store the reusable containers in the interim, between unloading and the backhaul.

The inventory management system use is related to scale

Currently it is clear that larger distributors are more likely to use inventory management systems (IMS). This makes sense given the high prices of the systems. Many of the smaller-scale businesses, however, are aware of the benefits such systems could bring to their operations, including electronic order picking, and the tracking of sales and deliveries.

Potential solutions to the high costs of IMS are emerging.

- Numerous groups across the country are in the process of developing open-source inventory management software specifically for food supply chains. If successful, this would remove the cost barrier for the software component of inventory management systems, though at first, the software could be of a lower quality.
- There is also potential in smartphone technology, which could be adapted to be used as scanners in inventory management systems.

Supply chain retention of product origination information is related to scale

This relationship has been previously articulated in numerous reports (see the Literature Review above). What these case studies illustrated, however, was that different scales of distributors devise different solutions to this challenge.

Potential solutions to the challenge of retaining product origination information:

- Smaller producers and distributors are able to label their boxes with their information, retaining their identity all the way to the end user.
- Ecker's, for example, maintains their orchard identity for all of its direct and farm-to-school sales, but loses it when they sell to the wholesalers. One wholesaler does have a separate brand for the apples grown in Ecker's particular region, which maintains a degree of origination information.
- Larger companies, such as Bix, are able to find balance by aggregating actual product, but then sending out weekly (or so) updates to their buyers, which list which farms are supplying them with which products—this allows the purchasers to advertise the suppliers of the product, but lessens the burden of keeping track of where each case of produce comes from, which is more difficult for larger operations.

Conflicting interstate freight regulations challenge smaller-scale distribution

A challenge unique to hauling is the variation between state trucking regulations. Different states might have different weight, vehicle and driver regulations, for example. For smaller operations, this presents challenges as they cross state lines to deliver their products. Not only can citations be costly, this also disrupts that day's delivery schedule.

Potential solutions to conflicting regulations:

- Smaller operations can contract with haulers that have larger fleets and more familiarity with interstate regulations, in order to get their products across state lines and potentially into larger markets.
- Policy makers can work to harmonize interstate regulations, perhaps using regional food systems as an example illustrating the necessity.

Facilitating the distribution of local foods makes business sense

Numerous larger businesses that we spoke with for this report demonstrated that it makes good business sense for the larger operators to integrate local foods into their product lines. Local Harvest Supply, as a subsidiary of Hawkeye Foodservice Distribution, was established in order to bring a local product channel to an established food service distributor. It thinks that this will only become more important as fuel prices increase, as local products require shorter shipping distances. Bix Produce, operating on its own and in conjunction with Sodexo accounts in the Twin Cities area, believes that forming strategic relationships with its local suppliers is part of being a private family-owned company that can invest in its community. Sodexo's recent decision to switch from using national suppliers to regional suppliers (Bix in the Twin Cities area) has greatly helped it keep track of where its products come from and generally increase its local sourcing, as regional distributors are more amenable to these requests. This increased ability to source locally helps the international company meet elements of its corporate sustainability goals.

Points initially emphasized by Day-Farnsworth et al. (2009)

As mentioned previously, these case studies also reiterate numerous themes and challenges articulated by Day-Farnsworth et al. (2009). More specifically, in this report we further demonstrate the innovative and dynamic nature of intermediated supply chains. Many supply chain partners conceive of solutions to various bottlenecks in direct response to those challenges, which makes the solutions highly specific, innovative and adaptive. For example, Ecker's Apple Farm's usage of "mobile storage"—the filling over time of refrigerated freight trailers which, once full, are picked up and hauled to buyers—demonstrates a cost-sensitive solution to Ecker's seasonal need for additional refrigerated storage on its property. This

solution is highly specific to Ecker's situation, but it is also adaptable beyond this single business. The concept of mobile storage could have potential as a low-cost point of aggregation for product from multiple farms—essentially, a “mobile food hub.” For example, multiple farmers could aggregate their product in the freight trailers at a fixed location, and then a hauler could pick them up once full.

Other noteworthy innovations encountered during this research include:

- Bix Produce's information sheets that communicate product origination information.
- Grass Run Farms' strategic internal partnerships that allow for specialization.
- Keewaydin Organics' development of an open-source inventory database software system to help match supply and demand.
- Local Harvest Supply's exclusive relationship with established foodservice provider Hawkeye Foodservice Distribution, which allows it to piggyback on existing deliveries.
- Sodexo's regional distribution model, which allows the international company to source more local products than if it used national distributors.

These case studies also reiterated the importance of strategic partnerships along the supply chain. Building strategic relationships through collaboration and trust breeds loyalty and the increased ability for supply chain partners to get local food products to market. Good examples of how these strategic partnerships can increase capacity can be found in Bix Produce's relationships with its growers, or Driftless Organics' partnerships with Star Valley Flowers and Edina Couriers. Without these relationships, each of these businesses would have a much harder time successfully getting local products to market.

The importance of product aggregation was also stressed, once again, through these case studies. As aggregated product increases volumes, it is especially relevant to efficient distribution because it product aggregation can be the key to achieving economies of scale. Most case study participants recognized the importance of product aggregation and already seem to be taking steps in that direction, if they have not already fully integrated an aggregation model into their product distribution.

Finally, the seasonality of regional food products and the potential impact of weather events consistently pose challenges for the businesses profiled. Seasonality, which can be anticipated, affects which products are available when, and weather events, which generally cannot be predicted, create short-term yet serious challenges for distributors. Bix Produce, in particular, stressed how weather events can affect their supply. Since it gets its full stock of certain products from local suppliers during certain times of the year, when that supply stream is interrupted, Bix is left in a challenging position. These events are mostly unpredictable, and as such, Bix cannot have a back-up supply on its way from California, and instead needs to replace that stock at an increased cost through local wholesalers or other suppliers. With regard to seasonality, this makes it more challenging for distributors and haulers, as they need to supply varied services throughout the year, and they are not able to establish regular, consistent orders from their suppliers.

Conclusions, Recommendations, and Potential Tools

Identification of Distribution Variables

When supply chain partners make decisions about product distribution, each has a different combination of variables to consider. Some variables are obvious, such as delivery costs related to fuel price, employee time, and distance traveled. However, distributors and buyers also need to consider particular product attributes, such as the available volume, the volume-to-weight ratio, product seasonality, grading and certification, shipping needs (refrigeration, freezer, etc.), and customer preferences—factors that can be complicated by the shorter growing season, smaller scale of production, and less industrialized nature of many producers focused on local markets.

From a logistics perspective, location and proximity are other significant factors in supply chain configuration and transportation planning, particularly along intermediated supply chains where there are economies of scale. A supplier's proximity to major trucking or freight train routes can greatly increase that supplier's ability to scale up by accessing larger distribution networks. For example, if a medium-sized supplier is located along a major trucking route already frequented by a hauler, this increases the chances of that supplier and hauler working out a distribution service, perhaps even via backhaul. Conversely, while the development of ad hoc remote distribution hubs may serve the immediate aggregation needs of a cluster of producers, the farther hubs are located from main thoroughfares, the less likely they will be able to tap into external freight transport systems and reduce costs by leveraging existing transportation infrastructure.

Finally, values-based decision-making is also present in many local and regional food supply chains. Here, partners make business decisions based upon social and environmental factors in addition to economic ones, obviating the use of simpler cost/time optimization tools to aid decision-making in local and regional supply chains. In fact, we could find no single variable that if optimized could predictably increase the efficiency and thereby profitability of local/regional food supply chains. While there is no “magic volume” or other variable of critical mass, that when reached indicates that producers should contract out distribution services or that aggregation hubs should relocate nearer to larger volume freight routes, our research does point to emergent best practices ranging from low-tech, seasonal storage strategies and route planning to multi-business aggregation and distribution hubs to strategic alignment of distinct scales of suppliers and distributors to best accommodate variation in local and regional production capacity and market demand.

While the lack of hierarchy within distribution variables complicates the potential usage of conventional freight networks for distribution of local/regional foods, communicating these variables and best practices to actors across the supply chain can enable suppliers, distributors, and buyers to better understand each other's business decisions and identify opportunities to forge partnerships.

Lastly, perceived benefits are often nearly as important as real benefits when it comes to decision-making along the supply chain. Often supply chains are highly regimented and changes in sourcing, packaging, and logistics can be perceived as disruptive, even in instances when they can actually lower costs or expand market access. This underscores the importance of ensuring that supply chain partners understand and even preempt other supply chain partners' concerns about new distribution or sourcing options. For example, a number of the smaller businesses we profiled for this study are concerned about the consequences of switching to a contracted hauler from self-delivery, as it would cut down on valuable face-time

with their customers, even though it would likely increase their delivery efficiency. In these instances, if haulers first understood this concern, they could better market their services and address the concerns of producers who would be switching from direct distribution. Together, the producers and haulers might be able to devise a mutually agreeable solution. The more that supply chain partners can speak in consistent terms, the more likely that the various businesses can work together. Again, articulating these variables can help establish this consistency.

Audience or Topic-Based Fact Sheets

To help producers, aggregators, distributors, and buyers who are active in local food supply chains better understand the decision-making processes of their supply partners, variables affecting supply chain configuration and distribution strategies could be identified and detailed on audience or topic-based distribution fact sheets. Fact sheets could be directed at producers, distributors and buyers. Alternatively, fact sheets could be topic-based, identifying, for example, route planning strategies or inventory management options.

Examples of information that could be included in audience-based fact sheets include: how producers can calculate their cost of distribution, how buyers can shop around for distributors that will help them meet corporate sustainability goals, or how distributors can create and market a service aimed at producers who currently distribute their own products. In short, these fact sheets could inform different supply chain partners as to what they can do to make the supply chain more efficient and increase local food options.

Topic-based fact sheets could, for example, focus on strategies for route planning, valuing costs of distribution, and how to match supply with demand. The different topics could further be explained in terms of business scale, describing how different tools work for different sized operations.

A fact sheet for policy makers could also be useful. As our case study interviews specifically identified state regulations and inconsistencies between them as significant barriers for small producers and distributors that serve multi-state markets (indeed the Twin Cities are much closer to many of the producers in the Driftless Region of Wisconsin than Wisconsin metro areas such as Madison and Milwaukee). Further, freight transportation is usually overseen and regulated by state and federal administrative agencies. Providing policy makers with fact sheets about regional food movements could allow them to make or change policies to more favorably accommodate regional distribution.

Online Tools

While virtually all of our case study subjects identified aggregation as either a necessity or highly beneficial, product aggregation remains a challenge that requires expertise in many areas, including local/regional food production, distribution and logistics, as well as sales and inventory management. Few small food distribution operations have adequate expertise in logistics, inventory and business management. Additionally, many small food producers and distributors have limited financial literacy. Together these limitations pose numerous obstacles to the development of physical aggregation facilities.

Virtual aggregation points represent promising alternatives and/or supplements to physical aggregation points. Several online local and regional food market places (Local Dirt and Food Hub) have emerged in recent years, and serve to aggregate product, connect producers and buyers, and facilitate orders. Additional efforts were initiated at the 2011 Making Good Food Work Conference to develop an open-source database that increases cross-supply communication to better align supply and demand. It will be compatible with existing online local

food market places. This proposed tool, spearheaded by the Tierra Miguel Foundation in San Diego, California has not yet incorporated a component designed to formulate routing strategies or increase backhauling, but these functions may be appropriate features to include in subsequent phases of database development.

Caveats and Limitations to the Analysis

In our case study research, our goal was to speak with different scales of distributors, ideally representing each of our products—apples, potatoes, and beef. In our timeframe, we were able to arrange such interviews for the smaller and mid-scale distributors, though we were unable to arrange an interview with a large-scale, mainstream distributor. We were able to gather aspects of the mainstream viewpoint, however, by speaking with Sodexo—a large-scale foodservice provider (buyer).

Recommended Further Research

This research illuminates new aspects of regional food movements, specifically the freight and logistics components of intermediated supply chains. However, it also raises questions about the regional food system. Our research did not closely examine the sustainability of the farming practices employed by the producers in the supply chains we studied. Production practices have significant bearing on the sustainability of regional food systems, as they directly impact water and soil quality, regional biodiversity, fossil fuel consumption, labor/output ratios, and other important factors. Further examination of whole supply chains will be critical in determining where the greatest leverage points are for improving the sustainability of regional food systems.

Future research could take a more in-depth look at the spatial relationship between production, consumption and transportation networks within a specific region. Specifically, this research could illuminate the transportation and economic implications of locating food hubs in particular areas of the research region. Or, for example, a case study looking at the potential usage of short-line rail in the Central Sands region of Wisconsin, where potatoes are grown at a commodity scale, could further highlight the potential, or lack thereof, of short-line rail in regional food distribution.

Another question raised by this research is how can a producer, scaling up to larger markets, accurately value its cost of distribution? Research that outlines how producers can effectively do this would benefit not only the producers, but also the distribution and hauling businesses that could provide these services. Currently, research efforts to this point are underway at the Land Stewardship Project in Minneapolis, Minnesota.

Finally, the development of regional food systems may have strong positive impacts on the economic development of the areas where the various businesses are located. A study looking more specifically at the potential impact could garner additional public and private support for these types of projects. A more in-depth study on the economic structure and impacts of food hubs could also benefit future research and establishment of such facilities.

Summary

The tension within many local and regional food distribution systems lies between values-driven decision-making on the one hand and an emphasis on optimizing time, fuel, and/or capital on the other. Values-driven decision making as reflected in sustainable production practices and an emphasis on personal relationships are characteristic of many small-scale farming and distribution operations. By comparison, mainstream supply chains typically place a premium on efficiencies achieved through time, fuel, and capital. Our research suggests that the strategic

utilization of haulers and distributors in regional food distribution can both facilitate specialization along the supply chain (thereby improving transportation and logistical efficiencies) *and* leverage values-driven decision-making to foster stronger partnerships between supply chain actors.

There are a number of advantages to strategically engaging third party haulers and distributors. For one, haulers and distributors not only have the equipment (e.g., trucks, software), they also have the expertise to navigate interstate trucking regulations. As distributors and haulers build volume, they are able to better plan and price for backhauls and take advantage of economies of scale, allowing them to lower their rates, which can translate to both higher returns for producers and lower costs for consumers. Secondly, strategic partnerships between producers and distributors and haulers can spur innovation and even create a climate of innovation among supply chain partners that benefits the region overall. Finally, the development of aggregation and distribution infrastructure and services such as food hubs can coordinate numerous aspects of the supply chain and broker relationships between producers and distributors. Helping producers and haulers/distributors to better understand each other's distinct business considerations can help forge relationships that open up new market channels. For example, a food hub can anticipate and help compensate for the loss in customer contact that producers may experience if they decide to contract with haulers, rather than doing their own delivery. A food hub employee or delivery driver can play a customer service role while the hauler efficiently distributes product to markets previous unavailable to that producer, due to volume or distance constraints.

Indeed, specific supply chain configurations will depend on a given producer's needs and scale. Some producers may find that distribution partnerships with other producers make more financial sense than contracting with haulers or distributors. Identifying costs of distribution can help producers better understand what decision is appropriate for them. Further research on the spatial relationship between production and consumption, the environmental sustainability of the farming practices used by farmers selling via local markets, and the economic development potential of such local food economies would help articulate, and hopefully align, the goals of business owners, practitioners, and policy makers. Ideally, as this research builds, best practices for a robust and sustainable local food economy will emerge.

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