Freezing Regional Produce for Western New England

A Report on the Extended Season Farm-to-Institution Pilot Project

Prepared by Jill Fitzsimmons for the Franklin County Community Development Corporation and CISA (Community Involved in Sustaining Agriculture)

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Introduction and Background

Institutional interest in purchasing regionally grown food is booming. In 2009, the Western MA Food Processing Center (FPC) recognized that there was an increasing demand for extended season, regionally grown produce in Western New England. In 2010, the FPC conducted the Extended Season Farm to Institution pilot project to determine the level of interest in and capacity for a wholesale farm-to-institution frozen product market in Western New England. The goals of the pilot were to:

- Use existing FPC equipment and facilities to freeze a narrow range of appropriate products;
- Establish relationships with potential growers and purchasing institutions;
- Identify and assess value-chain deficiencies[1];
- Identify project-related needs and costs;
- Determine potential cost and efficiency barriers for growers, the FPC and institutions;
- Provide a basis with which to determine the feasibility of operating an ongoing Farm-to-Institution Extended Season program.

The Western MA Food Processing Center, located in Greenfield, MA, opened in October 2001 to provide space and equipment for food businesses to start and grow. The FPC is owned and operated by the Franklin County Community Development Corporation (FCCDC), a private non-profit organization. During the first 9 years of operation, over 200 businesses have used the FPC. The facility consists of multiple-use equipment including steam kettles, a tilt skillet, convection ovens, mixers, choppers, labelers, 3,500 square feet of dry storage space, two walk-in coolers, two walk-in freezers, and a full-time manager who oversees the facility, trains users, and manufactures products for businesses as a co-packer. Two different-sized loading docks are available as well as a forklift and pallet jacks. The FPC specializes in adding value to locally grown produce. Several farms have used its services to produce apple sauce, tomato sauce, and a variety of specialty food products. Most of the users are food entrepreneurs who produce specialty food items and market them to independent and chain food stores.

2010 Extended Season Farm to Institution Pilot Project Overview

The 2010 pilot project successfully sourced 2,000 pounds of locally-grown broccoli from two local growers/aggregators, froze and packaged the broccoli at the FPC, and delivered the final product to a local public school district. The pilot incorporated lessons learned from 2009, when the FPC had been hired by a client as a co-packer, and

[1] Cantrell, Patty. 2009.

processed and froze several thousand pounds of produce – broccoli, snap peas, snow peas, and corn. The 2009 and 2010 experiences provided a solid basis with which to assess the viability of freezing local produce and the long-term feasibility of the project.

Prior to running the 2010 pilot, six institutions were interviewed to determine their interest in purchasing frozen product, desired characteristics of the purchased product, and contracting arrangements. Three regional growers and one regional produce aggregator were interviewed to determine the availability of produce and to explore contracting arrangements.

The outcomes of these initial interviews focused on four potential products – frozen green beans, broccoli florets, chopped broccoli, and cauliflower florets, in order of potential demand and availability. Each institution indicated an initial interest in purchasing between 1,000 and 15,000 pounds of a particular product in a season, assuming comparable quality and price, and the local producers indicated that sourcing this volume would be possible.

The FPC prepared test batches of each of these four products, which were given to one of the interviewed institutions. This institution tested the product in their kitchen. Based on the product demand, results of the test batches, existing equipment and production costs, and cost and availability of fresh produce, the FPC decided to run a 2010 pilot focused on producing frozen chopped broccoli.

The FPC and one institution made an informal agreement to source and freeze between 700 and 5,000 pounds of chopped broccoli at the price of $1.10/pound. The institution had limited existing frozen storage capacity and a refrigerated truck and was willing to pick up and store the frozen product. The FPC sourced the produce from local farmers and aggregators, received fresh produce, processed the produce, stored the frozen product for a few weeks, loaded it into the refrigerated truck, and billed the institution at the previously agreed upon price.

In late spring 2010, the FPC contacted one grower and one aggregator to confirm that up to 5,000 pounds of broccoli would be available, and that it would be possible to receive deliveries of fresh produce of at least 2,000 pounds in the early morning. Given existing equipment and the need to hire temporary workers for production, it was determined that 2,000 pounds was the most that the FPC could process in a reasonable production day, and therefore the most efficient use of existing equipment, space and employees.

The FPC continued to check in with the grower and aggregator throughout the growing season to confirm interest and keep abreast of the broccoli crop. In late summer, the FPC received a delivery of broccoli and processed it. The FPC then contacted the purchasing institution and arranged for pick-up and billing.

The chopped broccoli was served at the institution in December 2010. Both the food service staff who prepared the broccoli and the students who ate it were quite happy with the product. The food service director stated:

> "We served your broccoli on Friday as the vegetable of the day and so far I have received nothing but positive feedback! Kids liked it more than any other cooked broccoli we have served before. I also did a demo for the cooks last week for an upcoming broccoli ham and cheese calzone will be serving for lunch on the 15th. Everyone really like the finished product, in large part because of the freshness/flavor of the broccoli. "

Produce was grown, processed, and consumed within the region to the great satisfaction of all parties. Overall, the pilot was a success. The produce traveled approximately 50 miles from harvest to consumer as opposed to 3,000 miles for some of the institution's other frozen products. The post-pilot evaluation indicated a continued interest on the part of pilot participants, as well as interest from other regional growers and institutions. The FPC was able to identify that the project has the potential to grow and be financially viable. In addition, the pilot participants were able to identify challenges and potential solutions for barriers to long-term viability.

This report identifies in detail the challenges and potential solutions identified in the course of the 2010 Extended Season Farm to Institution pilot project. We will briefly look at a potential regionally-grown frozen wholesale value chain, crop supply, product demand, processing options, contractual relationships, storage and distribution, and project management options. We will then provide a cost analysis and make recommendations for next steps based on our findings.

Regionally Grown Value Chain

To assess the potential wholesale frozen vegetable value chain within the region, the FPC made a rough sketch of the current market for regionally grown produce, as we understand it. To our knowledge, there is no existing research documenting this market, and researching the entire regional produce market was out of the scope of this project. Our knowledge is most accurate for the Connecticut River Valley, though we extrapolate this knowledge to the Western New England region.

The 2010 USDA report "Local Food Systems: Concepts, Impacts, and Issues" offers a helpful compilation of similar studies from around the country, as well as a useful common set of terms, which we employ throughout this report[2].

[2] Martinez, S. et.al., 2010.

The value chain is identified by two existing product channels available to regional producers: fresh direct-to-retail/foodservice, and fresh direct-to-consumer product channels at the producer level. These fresh direct product channels are characterized by their short supply chains, which allow growers to capture a larger percentage of the sales price[3]. At the same time, this chain involves additional tasks for growers, such as marketing, storage, distribution, pricing, and sales. Generally, smaller scale fresh direct growers can absorb these additional tasks given their smaller volumes[4].

However, larger growers (50 – 150 acres) either need to invest in on-farm capacity or contract off-farm to accomplish these tasks. Some of the tasks listed above are accomplished by selling to a fresh wholesaler or aggregator, or by selling fresh wholesale directly to an end user in the form of a large institution. Part of the appeal of these options appears to be due to grower access to well-established and grower-friendly fresh wholesale market value chains.

This fresh supply chain, however, is valid only during the harvest season for non-winter storage crops. For these crops, local procurement between October and June is nearly impossible. Gaps in the value chain exist for these crops. Existing infrastructure which might provide extended season market opportunities to mid-scale growers is limited in western New England, and the costs of investing in on-farm capacity to fill the market gaps can be too high for individual farmers.

One proposal to fill some of these gaps is for a centralized processor to freeze locally grown vegetables during the growing season for consumption outside of the growing season. Certain pieces of the infrastructure needed to achieve this exist, although many do not. Key pieces, such as market relationships, efficient processing equipment, pricing mechanisms, certified processing facilities, storage, and distribution options would need to be addressed. This proposal necessarily adds many of the above complications back into the simple fresh direct value chain. This report aims to use the results of the FPC's 2010 Extended Season Farm to Institution pilot project to assess the viability of this proposal.

[3] Blum-Evitts, Shemariah. 2009
[4] Martinez, S. et.al., 2010.

Potential Value Chain

In considering potential frozen value chains, we begin with producers and aggregators within these existing fresh direct product channels which have the capacity to deliver at least 2,000 pounds of fresh produce in a single day at least once, and ideally more than once a season; generally, these are medium- to large-scale producers, (50+ acres).[5]

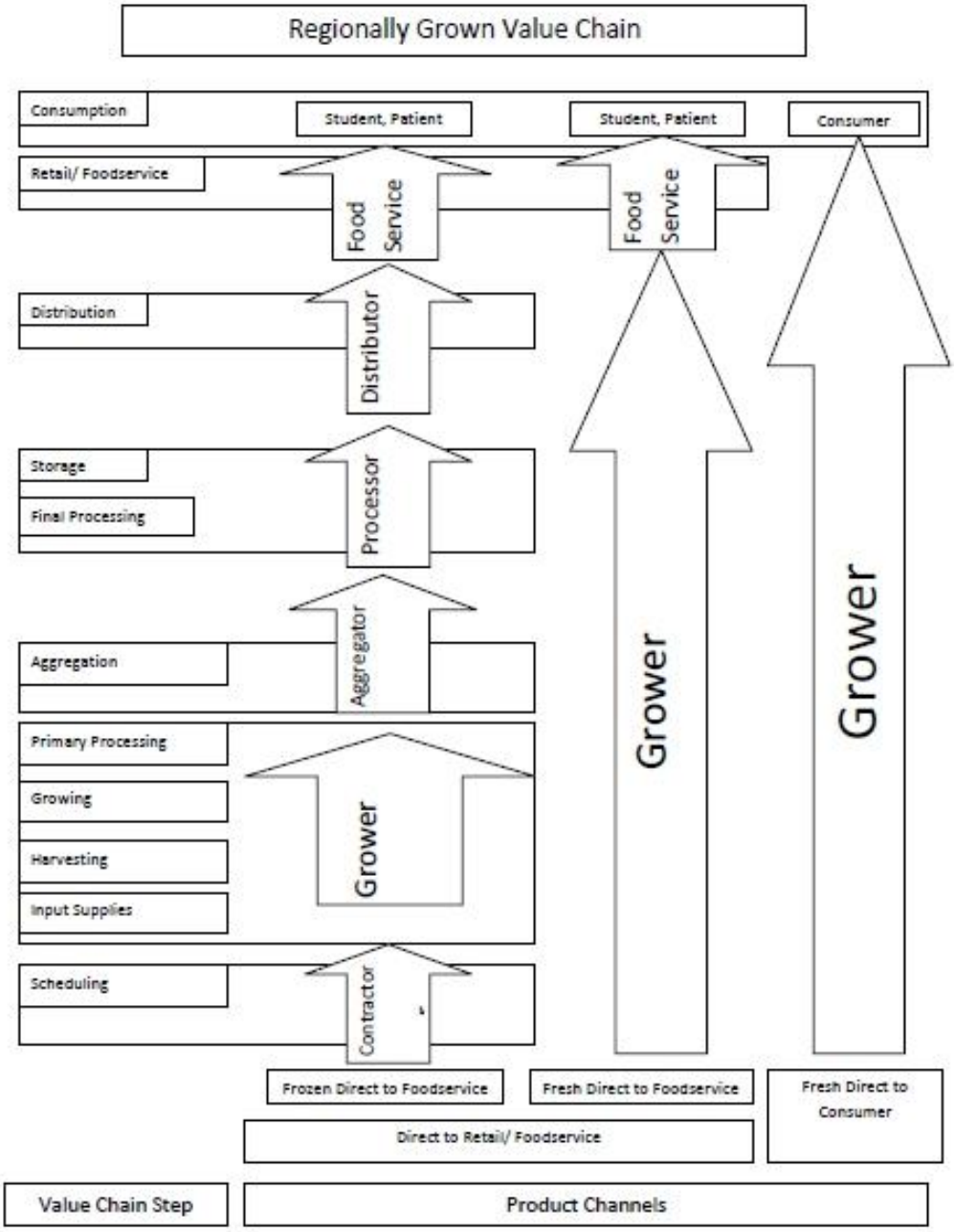

Figure 1. Potential Regionally Grown Value Chain.

[5] Joshi, A., et. al. 2007.

Arguably, smaller independent producers could aggregate product to meet this baseline as well, but for the purposes of this report we do not include this option, due to the higher transaction costs of working with multiple small-scale producers. Further, we assume that many small to medium sized producers (between 1-50 acres) will prefer to remain in the fresh direct channel.

We then further divide the direct-to-retail/foodservice potential product channel into frozen wholesale and frozen retail. The following value chain description is based on the medium-to-large sized producer frozen wholesale direct-to-food service value chain.

The direct-to-consumer product channel also has the potential for a frozen value chain. In fact, during the 2010 season two CSAs co-packed produce at the FPC in order to have frozen product for winter CSA shares and winter farmers' markets. Unfortunately, the CSAs will not distribute the product until late winter, and therefore won't be able to evaluate this product until after this report is concluded. Additionally, the regional cooperative grocers association has indicated interest in piloting a direct-to-retail frozen product value chain project.

Potential Frozen Wholesale Direct-to-Foodservice Value Chain

Making an initial contact, and perhaps contracting with the growers and purchasers, is considered to be a first step in the value chain. Input supplies are provided by the grower. The crop is grown and harvested by these growers. After harvesting, primary processing of the produce, including sorting, wholesale packing and chilling, is done by the grower (in some cases, primary processing such as bean snipping or winter squash peeling may also be done by growers). The produce is then shipped from the grower to a processing facility by either the grower or an aggregator (for the rest of this report, we will assume the FPC in the role of the processor)[6]. The FPC then processes, freezes, and packs the finished product. The FPC stores the product, at least temporarily, and the product is then transported and stored at the institution or at a frozen storage facility. It is then distributed, preferably in a refrigerated truck, from the FPC to storage and/or directly to the purchasing institution. The institution prepares and serves the product to consumers.

Crop Supply

There is very limited public data which directly describes the supply, availability, and market price of specific vegetable crops within a region. The USDA's National

[6] Note that the FPC is identified as the facility in the Pioneer Valley with the capacity to process and freeze local produce. Inefficiencies and infrastructure gaps exist both within the facility (currently available equipment, program support, technical assistance, pricing) and outside of the facility (storage, distribution, marketing, sales, existing relationships). Some of these gaps could be filled either within or outside of the FPC.

Agricultural Statistical Service (NASS) conducts both an annual survey and a once-every-five-years census of farmers in the U.S. The Census is compulsory and comprehensive[7], but is designed for national data purposes, and the data categories and scaling are often not relevant to small and medium sized New England producers. The Survey relies on self-reported data, is not comprehensive, and does not distinguish between grower characteristics or market characteristics. It is difficult to draw strong conclusions from this data regarding pricing and availability of a certain product to local markets.

Regional Supply and Availability

However, cross-tabulating Census and Survey data from 2005-2009 provides an estimate of the regional yield of specific crops[8]. We will use this data to describe the current supply of four specific vegetable crops in western New England states, including New Hampshire, Vermont, Massachusetts, Connecticut and Rhode Island to demonstrate that these crops are viable in this region, and that there is an existing supply. The four vegetables were selected as a result of our research on product demand.

Western New England (CT, MA, NH, RI, VT) Crop, 2007 N.A.S.S. Census	**Acres Harvested[9]**	**Weighted Average Yield (Lbs/ Acre, 2005-2009)[10]**	**Total Pounds**
CAULIFLOWER	47	7,491	352,077
BROCCOLI	177	3,015	533,687
PEPPERS, BELL	919	16,619	15,273,200
BEANS, SNAP	1,639	3,401	5,573,983
Total	**2,782**		**21,732,947**

Figure 2. Western New England Crop for Four Potential Frozen Products, 2007.

In 2007, forty-seven acres of cauliflower, 177 acres of broccoli, 919 acres of bell peppers, and 1,639 acres of snap beans were harvested in western New England. Taking the weighted average from 5 years of NASS Survey reports, we determined an average yield per acre for these crops in this region. The result shows that growers in western New England grew about 21,732,947 pounds of the vegetables that are in most demand as frozen products in institutions. Of course, this produce is currently flowing through existing wholesale and retail value chains.

[7] Soto, R. and A. Diamond. 2009.
[8] Personal Interview, 2010.
[9] USDA National Agricultural Statistics Service. 2010. "New England Fruits and Vegetables 2009 Crop".
[10] Appendix C.

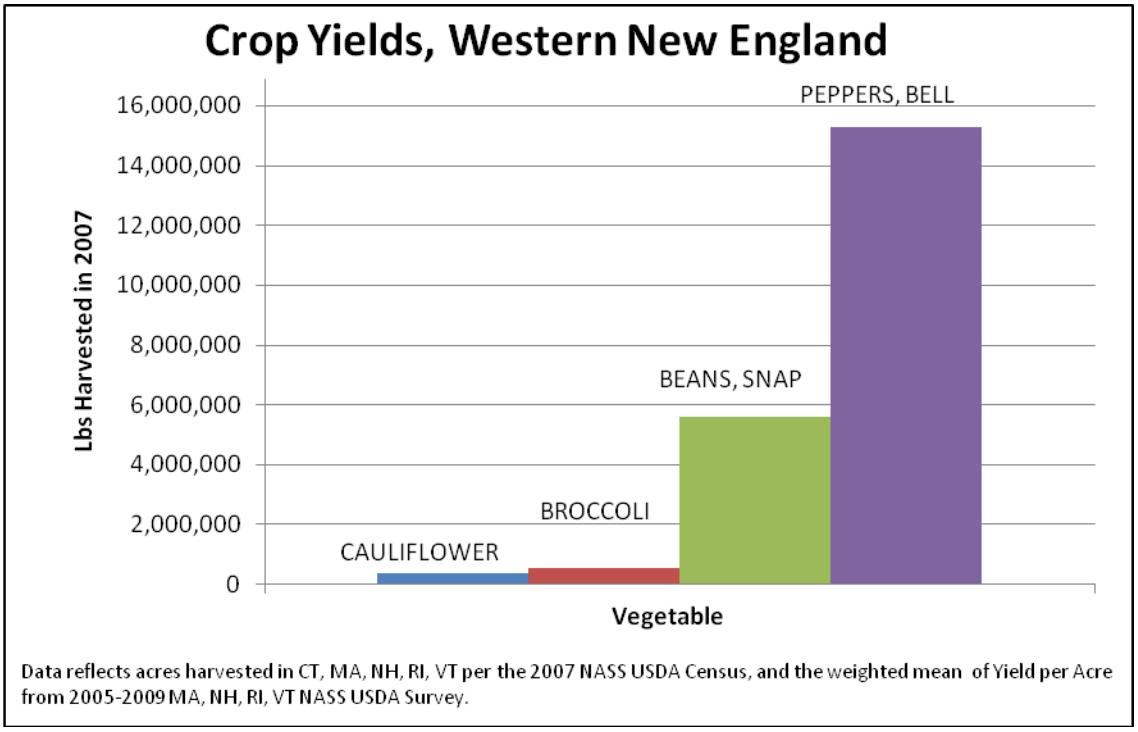

Figure 3. Crop Yields, 2007.

In 2009, we surveyed 9 regional growers from different sized farms to determine their interest in the project. These growers were generally interested, although logistical issues and volume requirements prevented the FPC from sourcing produce from smaller growers for the 2010 pilot. For the pilot, we worked with one grower in Western Massachusetts, who operates a medium to large sized farm, and a co-operative aggregator who works with 35 regional farms. We interviewed them again in 2010 to determine whether produce could be accessible to us at a competitive price in the volume which we would need to justify scaling the project up and maintaining medium-term viability.

As an example, this grower and aggregator sold about 500,000 pounds of fresh regionally grown broccoli in 2010[11]. Between the grower and the aggregator, an additional 125,000 pounds of green snap beans were sold in 2010, and about 450,000 pounds of bell peppers. The grower, one of the original contacts we made in 2009, choose to increase the acreage of broccoli he grew specifically to supply broccoli for our pilot, and indicated a willingness to increase his broccoli production further in the future. The aggregator firmly made the point that many of the growers he works with would gladly increase production of a specific crop if they were offered a fair contract early in the season. In addition, both the grower and the aggregator expressed interest in growing a larger volume of brassicas (broccoli and cauliflower, for example) because

[11] Personal Interviews, November 2010. Note that figures from the aggregator include product from New York state, unlike the NASS western New England figures cited above.

they are not susceptible to fusarium wilt, a soil-borne disease becoming more and more prevalent in the region.

Taking this information from two sources within 30 miles of the FPC, and the NASS data from western New England, it appears probable that the supply would be sufficient for the project to be viable.

Prices

Pricing, as provided in certain annual survey-based reports[12], is an average of organic, retail, and wholesale sales at the point of first sale, but because the proportions of each are not published it is impossible to estimate an average wholesale price. Produce price spreads published by the USDA's Economic Research Service show that nationally, farmers received from 35.8% of the retail price for broccoli in 1995, to 26.9% in 2009[13]. For processed fruits and vegetables, that percentage has declined from 21% in 1995 to 15% in 2009[14].

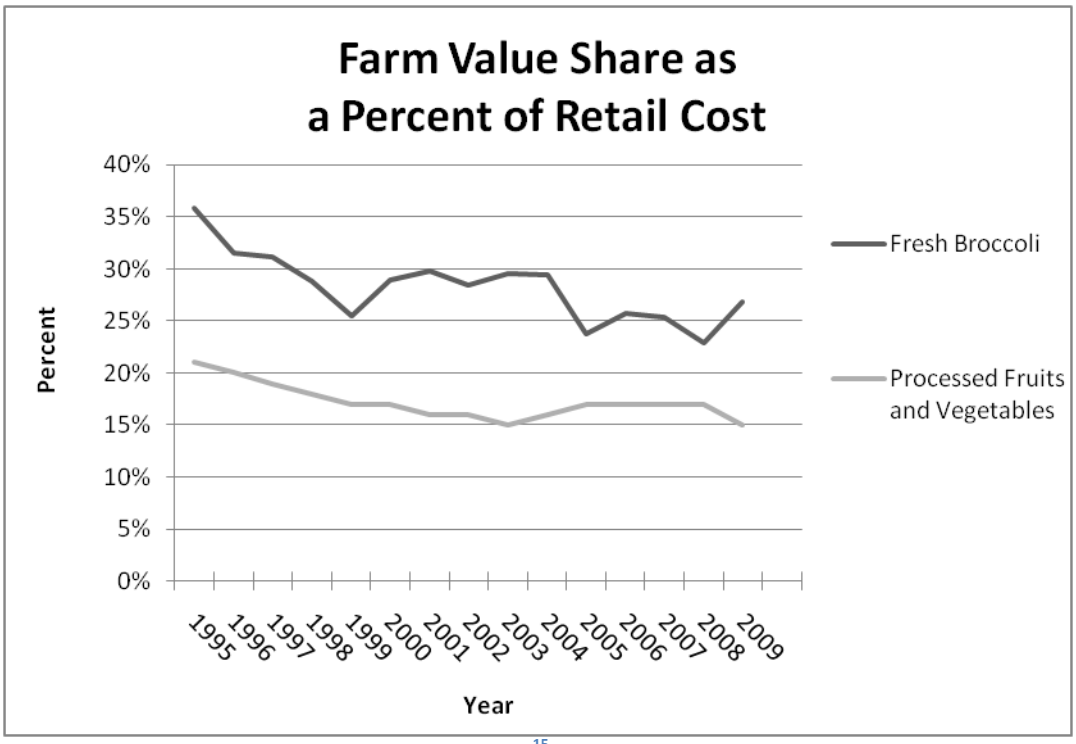

Figure 4. Farm Value Share as a Percent of Retail Cost[15].

[12] USDA National Agricultural Statistics Service. 2010. "New England Fruits and Vegetables 2009 Crop."
[13] USDA Economic Research Service, 2011. Fresh Broccoli.
[14] USDA Economic Research Service, 2011. Processed Fruit and Vegetable Market Basket.
[15] USDA Economic Research Service, 2011. Fresh Broccoli. USDA Economic Research Service, 2011. Processed Fruit and Vegetable Market Basket.

According to the aggregator and producer, fresh, regionally grown broccoli in the 2010 season sold at a wholesale price of $0.60-$0.70/pound[16]. Green snap beans sold at $0.64-$0.74/pound wholesale in 2010, and cauliflower at about $1.30/ pound.

One of the primary goals of the project is to provide a competitive price to the grower, and the primary competition for this product within the region is the fresh wholesale market. Thus, we have used local producers' wholesale prices as our baseline for determining the project's viability.

Product Demand

Institutional interest in purchasing "local" food is growing across the country: according to the National Farm to School Network there was a 523% increase in the number of farm to school programs from 2004 to 2009[17]. This demand appears to translate to Western New England:

> "There's just a lot of demand for the local product by the institutions and kind of a scrambling in the [agriculture] industry to meet that demand because so many of our farmers are not wholesaling any more, they're selling direct to consumers"
>
> Kelly Erwin, Massachusetts Farm to School Project, February 18, 2011[18]

Prior to running our 2010 pilot, we briefly interviewed six institutions to determine their interest in purchasing frozen and canned products and desired characteristics of the purchased product. Each institution expressed a strong interest in purchasing frozen and canned regionally grown produce. We interviewed four of these institutions in depth, including one large public school district, one medium-sized private school, one hospital, and a co-operative grocers association. These in-depth interviews were designed to assess the specific demands for product selection, quantity, characteristics and food safety. Other interview responses regarding contracting, delivery, storage, and customer relations will be addressed in other sections.

Product Selection

The institutions interviewed expressed interest in a wide variety of lightly processed products. The list of products began with produce that could be, and currently is, successfully grown in New England. From this list, institutions expressed interest in purchasing at least 500 pound orders several times per year of the following products:

[16] Personal Interviews, November 2010.
[17] Martinez, et. al. 2010.
[18] Rathke, Lisa. 2011.

Comprehensive List of Products, as identified by interviewed purchasers, 2010[19]				
	Public School	Private School	Hospital	Co-Op Association
Frozen				
Asparagus, Tips			X	
Beans, Green, Cut	X		X	
Beans, Green, Whole	X	X	X	X
Broccoli, Chopped	X		X	
Broccoli, Florets	X	X	X	X
Brussels Sprouts		X		
Carrots, Coined	X		X	
Carrots, Diced			X	
Cauliflower, Florets	X	X	X	
Corn, Kernel		X		X
Edamame, Shelled		X		X
Edamame, Whole		X		X
Winter Squash, Cubed	X	X		
Winter Squash, Mashed (in tubs)			X	
Parsnip, Coined			X	
Peas, Pods		X	X	
Peppers, Strips	X	X	X	
Peppers, Cubed	X	X	X	
Potato, Diced				
Zucchini, Half Moon		X	X	
Vegetable Medleys (eg, roasted roots, colorful heirlooms)		X		
Zucchini			X	
Raspberries			X	
Blueberries		X	X	
Strawberries		X	X	
Canned				
Beets		X		
Applesauce		X	X	
Peaches		X		
Pears		X		
Tomatoes, Crushed		X	X	
Marinara		X		
Pizza Sauce		X		

Figure 5. Comprehensive List of Frozen Products in Demand.

We selected chopped broccoli for the 2010 pilot because of the current equipment at the FPC, product availability, product demand, and the cost of production.

[19] Appendix A.

Quantity

It is difficult to put exact numbers on the potential demand for frozen vegetables in western New England, given the scope of this project. During the two informal surveys we conducted with regional institutions in 2009 and 2010, we gathered general information about the quantities of frozen products currently purchased by these institutions. We can use these to extrapolate, but remain aware that more thorough market research may be necessary to justify scaling the pilot up beyond our current projections. However, each institution interviewed expressed interest in purchasing "as much as we could give them," given a competitive price – not one institution was uninterested. Each institution, in particular the private school and the co-op grocers association, expressed a willingness to pay a marginal premium for regionally grown and processed food.

According to our interviews, the public school, private school, and hospital mentioned above are currently purchasing between 240-800 pounds of frozen broccoli per month. Both of the schools serve meals year round, although not quite as many as during the school year. Together these three institutions purchase about 13,000 pounds of frozen broccoli per year. They purchased about 7,000 pounds of frozen cauliflower per year, about 15,000 pounds of frozen green beans per year, and about 15,000 pounds of frozen vegetable medley per year. In our 2009 survey of schools, every food service director we spoke with indicated an interest in purchasing local frozen vegetables, and we feel confident that a large proportion of schools already purchasing local fresh produce will be interested, as well. In 2010 there were 250 public and private schools, hospitals, and colleges in Massachusetts alone who purchased fresh local food. If only a quarter of those schools were interested in purchasing local frozen as well, and each school purchased on average 400 pounds of broccoli per month, the demand would be near 30,000 pounds of broccoli per month, or 360,000 pounds of broccoli per year. This quantity can be sourced from within the region.

Product Characteristics

This is perhaps the most challenging aspect of providing regionally grown produce to local institutions. Institutions' food service providers have complex kitchen and storage requirements. Every product characteristic, from the loading dock to the plate is attenuated to increase efficiency, and to work within the constraints of time and space. In our interviews we asked many questions intended to identify where we would need to match our product to the needs of the kitchens, and where our production constraints could be accommodated by kitchens[20]. Clearly, it is in the best interest of the overall viability of the project to match the needs of the kitchens as much as possible, but we were encouraged that food service directors were flexible and responsive to making adjustments, as well.

[20] Appendix B.

Beginning with the product itself, we will briefly describe our current equipment and viable production capacity, and how the end product compares to the product currently used in institutional kitchens. In following sections, we will address contracting, billing, storage and delivery aspects.

Currently, the FPC has the capacity to receive, weigh, wash, trim, chop, blanch, shock, vacuum pack, box, and freeze certain products. These products include chopped broccoli, chopped cauliflower, brussels sprouts, pepper strips, blueberries, and strawberries. Other products in the Comprehensive List of Products above require some additional primary processing, for which the FPC either does not currently have equipment, or the labor cost would be too high to be viable (e.g. bean snipping, squash peeling).

We will take the example of chopped broccoli, which is the product we offered in the 2010 pilot. In general, food service providers purchasing frozen vegetables from their regular distributor would receive chopped broccoli in a plastic-lined 20 pound box. Each piece of broccoli in the box is frozen separately, in order to prevent clumping within the box. This allows food service staff to thaw and cook the product quickly. The product is relatively dry, which is an important factor in preventing clumping, and also allows less crystallization of water within each piece of broccoli, which preserves the texture of thawed broccoli. The process and equipment used to achieve this product requires an Instant Quick Freeze (IQF) machine. An IQF machine uses very cold liquids, such as liquid nitrogen, and a gentle agitating belt to quickly freeze individual pieces of product. Prior to entering the IQF, the broccoli is chopped in a large chopping machine. It is important to note that for most frozen vegetable production lines these machines are designed to handle specific products – so a large commercial frozen vegetable processor would have a dedicated chopping machine for broccoli, and a separate one for carrots, for example. The machine would be set up near the end of a wet line, again with belts, and the trimmed product would be sent through this line to be washed, chopped, blanched, frozen and packaged.

The FPC currently uses standard commercial kitchen equipment to process and freeze products. Taking again the example of chopped broccoli, FPC workers wash and trim the broccoli with knives, chop the broccoli in a 4 quart commercial food processor, blanche the broccoli in 2 gallon perforated pans in a 25 gallon tilt skillet, drain, shock the broccoli in two 50 gallon basins over running iced water, drain the broccoli in the perforated pans over sinks, and then pack the broccoli into 5 pound plastic bags. The bags are vacuum-packed and sealed, and four of the bags are placed into a box. The box is then stacked in the freezer and frozen. This process will be more thoroughly addressed in the processing options section below.

The resulting product for the end-user is a 20 pound box of four 5-pound vacuum packed packages of broccoli. The broccoli in each bag is frozen in one piece, and the

food service staff is required to open the box, open each bag, and thaw the single piece, as opposed to opening the box and cooking each individual piece.

The quality of the final product, as reported at the end of our pilot by the purchasing institution, is excellent. However, the packaging of the product does require extra steps for the food service staff, an extra cost due to more packaging, and extra time for thawing.

Food Safety

Another important product characteristic for schools, hospitals, nursing homes, and other institutions is food safety. The FPC is a certified commercial kitchen, with strict standards and oversight for correct processes and facility sanitation.

Freezing requires blanching and shocking produce, which kills food-borne pathogens. As discussed above, special attention is paid to critical moments in the processing to ensure food safety.

Prior to processing broccoli for the 2010 pilot, the public school district's food service management conducted a site visit to the FPC to verify that the facility met their company standards, which can be more stringent than government standards. In addition to passing this inspection with flying colors, the visit was an important reminder that a short value chain allows oversight and traceability, and builds relationships which contribute to a healthy and safe product.

Processing Options

As mentioned above, the FPC currently uses standard commercial kitchen equipment to process and freeze vegetables. While the equipment allows the FPC to produce an excellent product, the costs of production may be an issue in the long-term. If demand reaches anticipated levels, limitations in the FPC's equipment would make it difficult to provide growers with a fair price for their crop and maintain a competitive price for the purchaser. Increasing processing efficiency is necessary in order to ensure a fair price for all parties: the grower, the FPC and the institutional buyers.

We have researched three different processing options, and come up with a projected budget for each. We have anticipated a certain amount of growth over three growing seasons, based on both the available supply of produce and the likely demand for product (2010, 2011, 2012). We based our projections on a thorough evaluation of the 2010 pilot project, and will use the example of chopped broccoli to describe the options.

Option A

The first option, Option A, is to continue to process and freeze produce using the FPC's existing equipment, six staff (which includes the FPC Manager), and a new 640 square foot walk in freezer/cooler for storage. We will address the storage requirements below. This option, as mentioned in the Product Demand section, begins with the grower or aggregator dropping off sorted, cooled, wholesale packed and weighed produce at the FPC loading dock. The FPC receives the produce using a pallet jack, and weighs the product in a temperature controlled room.

Three staff begin by sanitizing and prepping the kitchen. Two staff then unpack and wash the produce in 5 gallon sinks while two staff trim the washed broccoli with knives. Another staffperson uses the RoboCoupe CL55 Processor to chop the broccoli, and the final staffperson then blanches the broccoli in perforated pans in the Market Forge tilt skillet. Two staff cycle back around and quickly shock the blanched broccoli in a cold water bath to stop cooking, and then drain the broccoli in perforated pans and colanders. Two staff then bag the broccoli in 5 pound plastic bags, weigh the bags on a digital scale, vacuum seal the bag, and load 4 bags into a 20 pound box. Staff members then load the boxes into the freezer, and leave the product for 24-48 hours to freeze. Staff clean and sanitize the kitchen.

This option takes 12.25 hours to process 2,000 pounds of chopped broccoli, and another 24 to 48 hours to freeze. Including the FPC Manager, Option A requires 66.75 staff hours. There are some key equipment-related bottlenecks in this option, which create inefficiencies in the production process and extend the required amount of staff time. In particular, the kitchen's capacity to chop the broccoli is limited by the capacity of the RoboCoupe machine, and the blanching capacity is limited by the temperature recovery time of the tilt skillet. The cold water bath is another bottleneck; the current method is to keep chill sticks and cold running water flowing through the sinks. Given the available volume of sinks and the time-sensitive nature of bringing the broccoli from 212 degrees to 38 degrees within 1 minute this method requires quite a bit off staff monitoring. Sealing and vacuum packing the bags is another constraint, as the machine fits four bags at a time. Finally, the freezing itself takes a long time, and has an impact on other freezer uses.

Inherent in Option A is the added staff time required to physically move the broccoli from one station to another. Most of the equipment used in this process is fixed, and cannot be physically moved to create a more efficient and streamlined process. The addition of the 640 square foot cooler/freezer is estimated to cost $46,880.

There are potential quality constraints with this method. For the end-user, the final product is different than the industry standard in that it is frozen in one piece, instead of individual pieces and it is packaged in 4 sealed bags per box instead of one lined box. The packaging and freezing method are the two aspects of the process that would necessarily need to be changed in order address those issues. An interim step could be

to improve the drainage in order to reduce the amount of water sealed into the package.

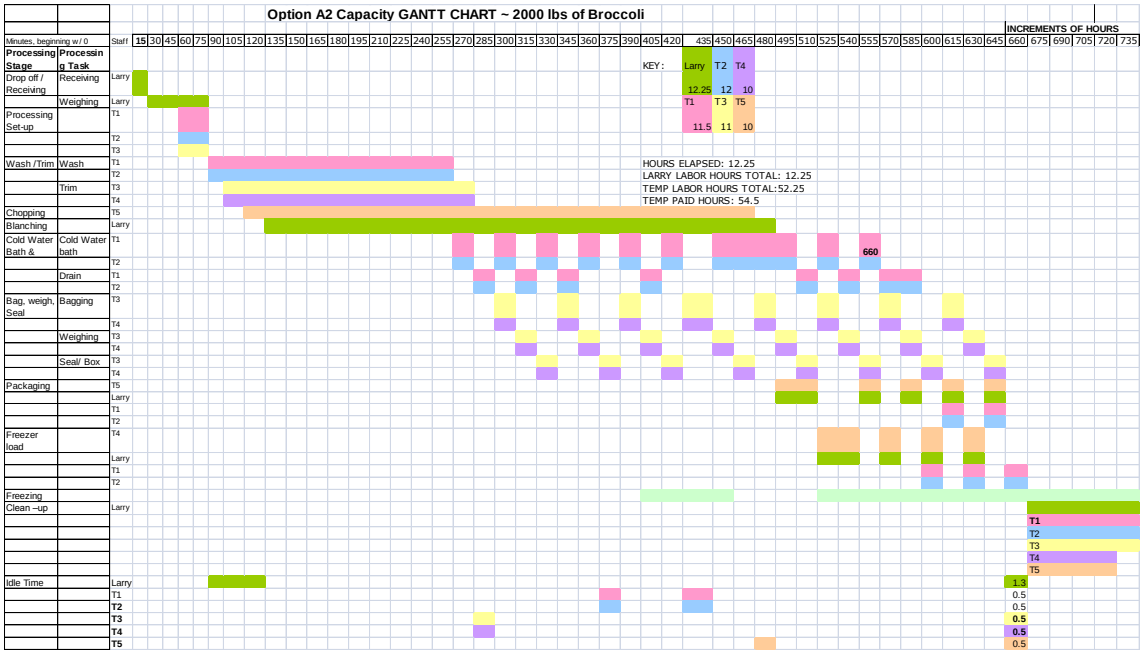

Figure 6. Gantt Chart For Option A Processing

Option B

The second option, Option B, is to purchase a 640 square foot freezer/cooler, along with additional processing equipment and a tunnel blast freezer to increase the efficiency of processing and freezing. We will continue to evaluate the process using 2,000 pounds of chopped broccoli, although it is important to note that an important benefit of Option B would be the increased volume of product that could be frozen.

Option B is the same as Option A up to the point of washing the broccoli. In Option B, four FPC staff would wash and trim the broccoli at a trim table/wash stand. The product would then move along an infeed belt to a Kronen GS 10 cutting machine, where one staff would operate the machine and chop the broccoli. Another belt would carry the broccoli to a blanch tunnel operated by one staff. After blanching it would travel by another infeed belt to a Kronen GEWA 2600V Eco Washing Machine, operated by two staff members, which would provide a temperature controlled, cycled cold water feed to shock the broccoli. From here the broccoli would be moved by one staff to a centrifuge to remove excess water.

The broccoli pieces would then be placed on lined trays, and loaded onto a twenty-tier Speed Rack by two staff. Each tier holds one tray of 3-5 pounds of product, likely the full 5 pounds for broccoli; each Rack holds 60-100 pounds of product. The cart would be

wheeled into the entrance of a Blast Freeze Tunnel. As Speed Racks are loaded, they would be moved into the entrance to the tunnel, and pushed towards the exit at the back end of the tunnel. Up to 1 hour is required for the contents of each Speed Rack to freeze. After an hour, the first cart could be removed from the back of the tunnel, and the pieces would be measured into plastic lined 20 pound boxes, the boxes sealed and loaded in to the walk-in freezer.

This option takes 8 hours to process and freeze 2,000 pounds of chopped broccoli. Including the FPC Manager, Option B requires 36 staff hours. This option addresses some of the key bottlenecks in our current process by using more efficient machinery. For the sake of comparison, we limited our description of this option to 2,000 pounds of chopped broccoli, however, with this equipment we would expect to double production for any given day, in order to give staff a full workday and to use the kitchen space most effectively.

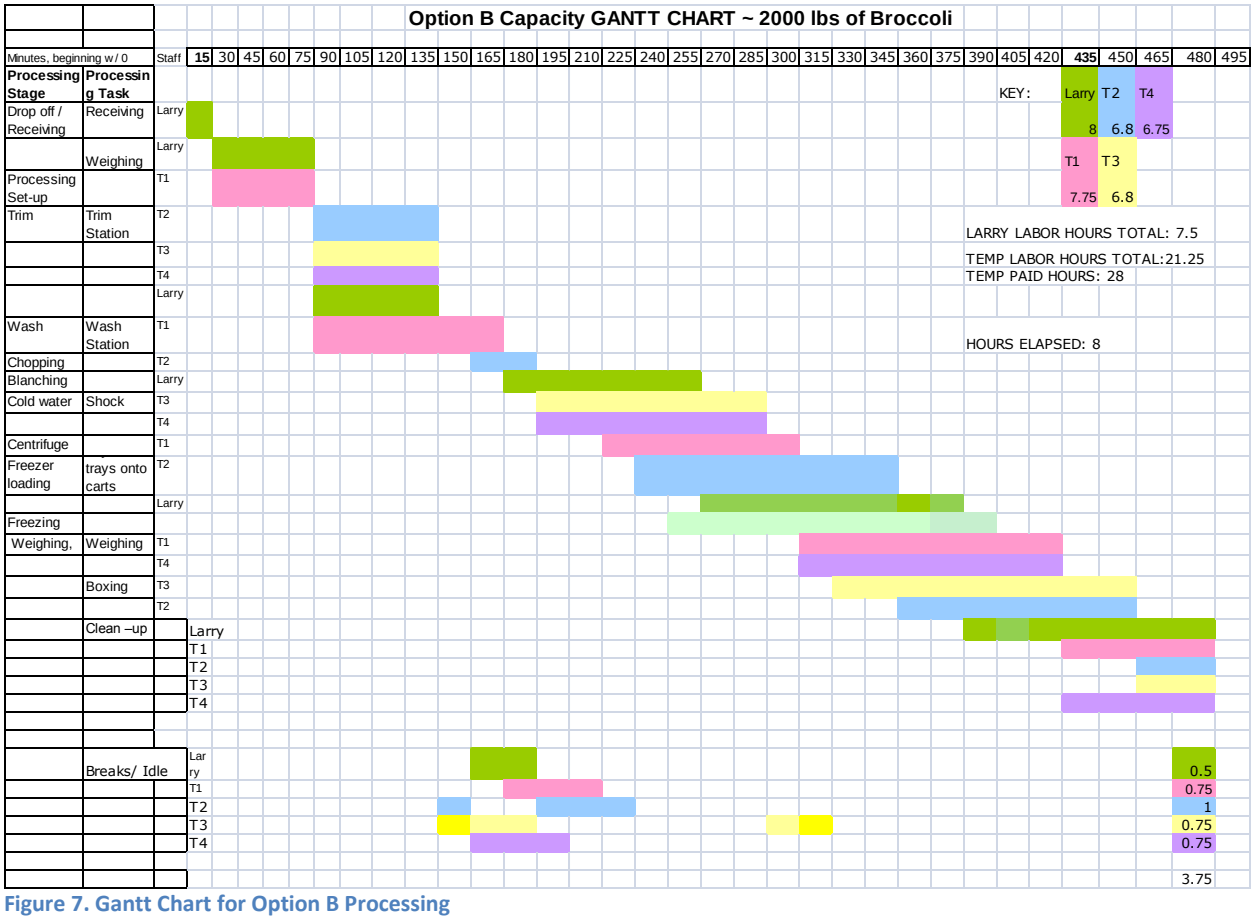

Figure 7. Gantt Chart for Option B Processing

Option B requires the purchase of significant pieces of processing equipment and a blast freeze tunnel, in addition to expanded freezer/ cooler space. The equipment purchases for a full line of products (broccoli florets, coined carrots, cubed squash, pepper strips) in addition to chopped broccoli are detailed in the table below.

Option B Estimated Equipment Budget	
Equipment	
Cooler/ Freezer (640 sq ft)	**$46,880.00**
Blast Tunnel freezer	**$150,000.00**
Kronen GS 10 Cutting Machine with Blades, Trim Table and Incline Converter	**$37,404.90**
Locking Casters	**$789.36**
Infeed extension belt	**$2,879.37**
Trimming Table	**$4,499.96**
Cubing Attachment	**$4,528.12**
Blade Disc	**$1,032.78**
Inclined Conveyor belt	**$11,455.77**
Strip Cutting Disc	**$1,913.60**
Two-wing knife	**$1,396.33**
Kronen HGW cutter	**$4,514.90**
Divider/ Corer Support plate	**$904.47**
Corer	**$552.40**
Airbro Floreting machine	**$20,787.97**
Washing Machine	**$23,232.22**
Centrifuge	**$7,552.40**
Baskets, Nets	**$753.40**
Blancher	**$4,200.00**
Subtotal	**$321,077.95**
Estimated Installation Costs	**15,500.00**
Total	**336,577.95**

Figure 8. Equipment Budget for Option B Processing.

Option C

Option C is similar to Option B, except for the use of an IQF machine in place of a Blast Freeze Tunnel, the staff time required to load the IQF machine and to box the frozen

product. The IQF machine could freeze the product to match the quality currently received by institutional purchasers.

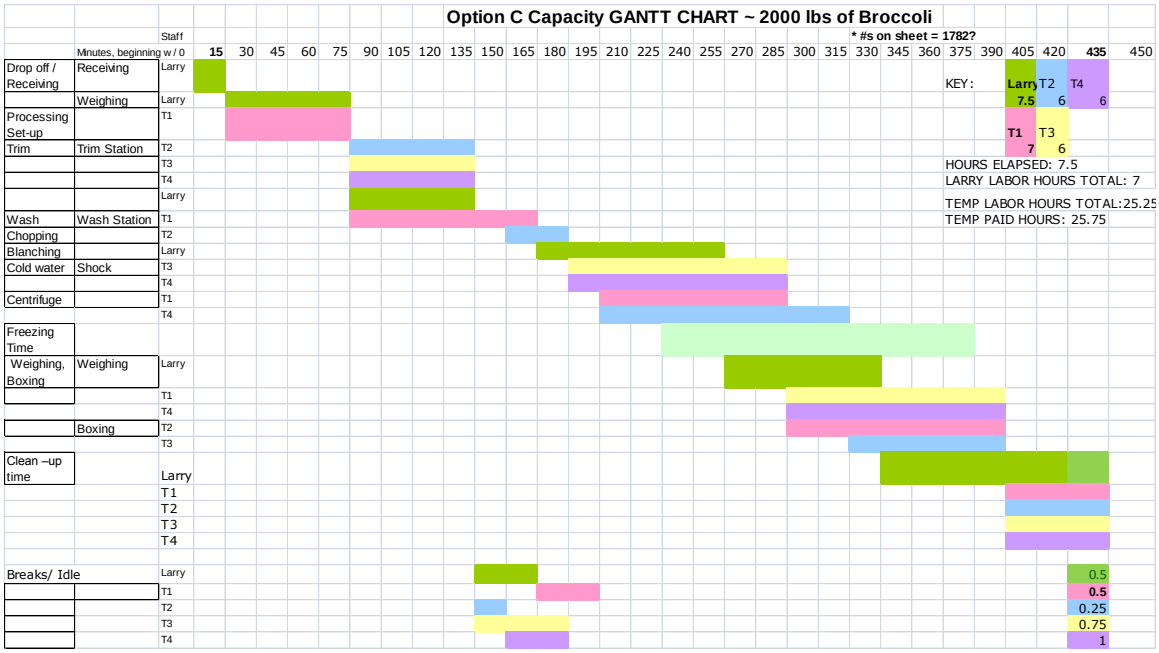

Figure 9. Gantt Chart for Option C Processing

This option takes 7.5 hours to process and freeze 2,000 pounds of chopped broccoli. Including the FPC Manager, Option C requires 32.5 staff hours. This Option addresses some of the key bottlenecks in our current process by using more efficient machinery, and reduces the overall amount of time required. For the sake of comparison, we again limited our description of this option to 2,000 pounds of chopped broccoli, however, with this equipment we would most likely double or more our production for any given day, in order to give staff a full workday and to use the kitchen space most effectively.

An IQF machine is an expensive purchase, and the time that it saves may not be adequate to justify the cost. IQF machines are quite large; the smallest capacity machine that we could locate processes 750 pounds an hour and costs about $400,000. While all of the equipment listed in Option B above could be used by other entrepreneurs in the FPC, and IQF would likely only be used for this particular product. Another consideration is that an IQF machine needs to be located in a very large and relatively cool temperature-controlled room (around 40 degrees Fahrenheit). The FPC does not currently have room for such a large machine, and would need to install a cooling system for such a room. Finally, an IQF machine that could be adjusted for different products would require a significant amount of adjustment and maintenance, for which we do not currently have trained staff.

Contractual Models

The successes of Farm to Institution projects seem to be rooted in the goodwill and enthusiasm of the participants. There are tricky logistical barriers at every turn, and navigating them requires ingenuity. How does the farmer know what to grow? Will the farmer deliver produce, and to whom does she give the bill? Can anyone read the bill? Does the business office have authorization to pay the bill? Does the food service contractor allow the school to purchase food outside of their contract? Is the farmer a Certified Vendor, and do they meet GAP and HAACP regulations[21]?

There are many thorough studies which detail the many barriers which Farm to Institution projects face, and adding processing to the value chain creates additional complexities, and therefore barriers. We will not detail each of them, but instead propose some contractual models that could address the primary barriers raised during this pilot[22].

Product Ownership & Transaction Costs

When a grower sells fresh produce to an institution, there is a distinct moment (upon delivery) when the grower stops owning the produce, and the institution begins owning the produce. The transfer of ownership is particularly important for perishable goods, where storage and distribution conditions are critical. If the grower delivers 2000 pounds of fresh broccoli, and the broccoli was left to sit in 85 degree heat for four or five hours and is wilted, the purchasing institution has the right to refuse delivery. On the other hand, once the institution has accepted delivery, it takes responsibility for storing produce in a refrigerated space. In each of these scenarios, potential financial loss is shouldered by the entity which has physical control over the produce.

Adding steps into the value chain means adding points where both the produce itself and the financial responsibility for the produce changes hands, as does the responsibility for and cost of caring for the produce. Considering that the primary goals of this project are to provide growers with a fair price, to allow institutions to purchase at a competitive price, and for the processing to be a viable enterprise, it is important to understand how the ownership costs and responsibilities can be structured in way that minimizes risk and cost to all parties.

Given that these risks and responsibilities affect at least three parties (growers, processors, institutions), it seems beneficial for all parties that agreements about ownership be contractual. In the 2010 pilot, the FPC relied on “gentlemen’s agreements” with growers and institutions; in the short term this is probably adequate,

[21] See Glossary of Terms.
[22] Joshi, A. et. al., 2007.

but if the project is to be scaled up to include more participants and larger volumes of produce, it will become more important to have formalized, written contracts.

In addition to addressing the ownership of the product as it moves through the value chain, contracts could also be an important way to manage transaction costs. As mentioned above, there are many barriers to growers entering the extended season market – these added tasks create additional costs that may not be justifiable for a medium sized farm. Likewise, institutions face barriers in working with suppliers outside of their existing food service contracts[23]. Both our interviews with institutions and our 2010 pilot highlighted how some of these barriers impact institutions and how contracts could ameliorate these barriers.

Communication, Order Placement, Delivery, Billing

Institutional food service providers, whether they are third party contractors or in-house, purchase food in large quantities from distributors. In our interviews, food service directors indicated a clear preference for distributors' streamlined systems: the product line, order placement, delivery, and billing systems are designed to fit the needs of institutional kitchens. Products and pricing are posted online and refreshed regularly, ordering is available online or by phone on demand, deliveries are scheduled on certain days and times to fit tight kitchen schedules, billing is automatic and meets the requirements of government procurement policies, and payment schedules correspond to tight budgets and monthly deadlines. As mentioned above, the product itself meets certain specifications for packaging and quality, and is designed to fit through corridors, in walk-in refrigerators, and to be quickly prepared by kitchen staff[24].

Ultimately, the FPC would develop systems to match institutions' needs. In the pilot and in the short-term, FPC staff would continue to work closely with growers and institutions to navigate these systems. Whether in formal or informal contracts, the FPC continues to work with growers and institutions to complete transactions and keep communications flowing.

Contractual Models

There are a handful of different locations along the value chain where financial or contractual ownership could shift. Using the detailed value chain for broccoli as an example, we identify these locations, and offer four basic options for contractual models.

Model 1 – The grower maintains contractual ownership of the product until the purchaser has received it. This option is analogous to a grower using the FPC as a co-packer after harvest.

[23] Joshi, A. et. al. 2007.
[24] Joshi, A. et. al. 2007.

Model 2 – The Purchaser has contractual ownership over product. This model is analogous to the purchaser using the FPC as a co-packer[25].

Model 3 – The FPC serves as a middleperson and takes contractual ownership over the product when it is purchased from the grower until it has been sold to the purchaser.

Model 4 – An entrepreneur launches a business to supply institutions with regionally grown frozen vegetable. The contractual ownership would likely mirror that of the FPC in Model 3.

[25] One caveat is whether purchasers will take the initiative for the 2011 and 2012 seasons. If not, it may be incumbent upon the FPC to begin to contact purchasers in January, as in other options, and build into those models a plan for transitioning out of this role.

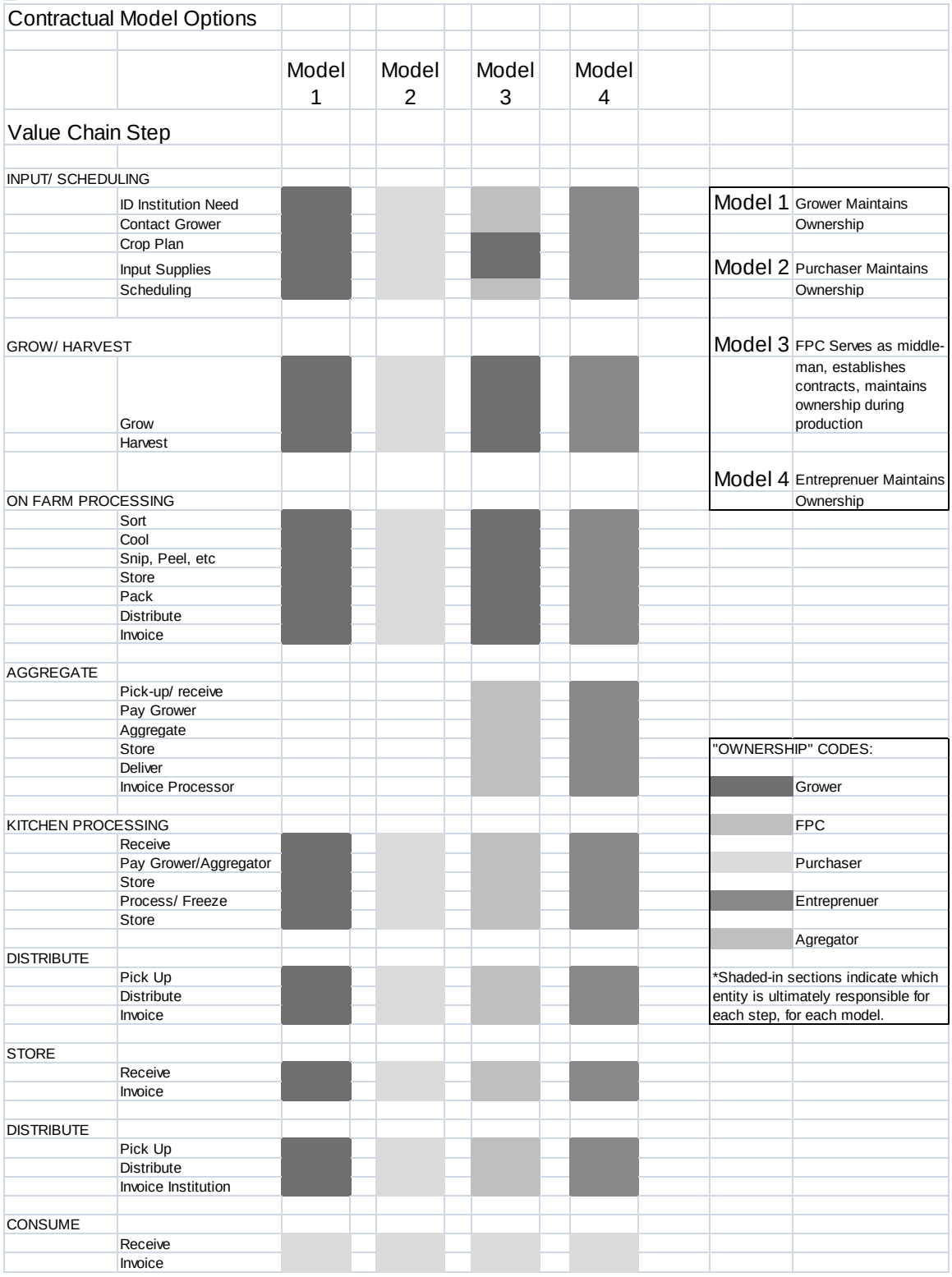

Figure 10. Contractual Model Options for Product Ownership.

Model 1 - Grower

The grower maintains ownership until the purchaser has received the product. This option is analogous to a grower using the FPC as a co-packer[26]. In this option:

INPUT/ SCHEDULING
Grower contacts potential purchasers. Potential purchasers identify the product and quantity they anticipate purchasing. Grower and Purchaser may agree on a contract price.
Grower makes crop plan which reflects the agreed upon product and quantity.
Growers purchase seeds.
Growers contact other value chain entities to schedule aggregation, distribution, processing and/ or storage.

GROW/ HARVEST
Growers grow and harvest produce according to certain specifications. For broccoli, in this example, the harvested product should be primarily heads with short stems.

ON-FARM PROCESSING
Growers undertake primary processing of the produce. This could include cooling the produce to about 40 degrees, sorting, snipping or peeling, and packing the produce in bins or boxes.
Growers store, and/or distribute the product under appropriate conditions. For broccoli, product is brought off the field quickly and is stored and shipped at 40 degrees.
Growers deliver an appropriate quantity to the FPC at a specified time. The quantity, quality, temperature, timing and packaging are critical at this stage. For example, 2000 pounds of fresh broccoli heads at 40 degrees packaged in 20 pound boxes delivered before 7 am. (We assume in this model that the grower does not use an aggregator or distributor).

KITCHEN PROCESSING
FPC receives and stores product under appropriate conditions.
FPC processes, packages and freezes product.
FPC bills Grower for co-packing services and/or storage.

DISTRIBUTE
Grower contracts Distributor, who receives product from FPC. Distributor delivers product to Purchaser or Storage.
Distributor bills Grower. If delivered directly to Purchaser, Grower bills Purchaser. If delivered to storage, see below.

STORE

[26] The FPC is hired as a co-packer to process a product, and is paid for the processing service provided.

If delivered to Storage, Storage receives produce and bills Grower.

DISTRIBUTE (optional, depending on whether product was in storage)
If product is in Storage, Grower contracts Distributor when the purchaser is ready, Distributor receives product.
Distributor delivers product to Purchaser. Distributor bills Grower.
Grower bills Purchaser. This price includes costs of produce, processing, storage and distribution.

CONSUME
Purchaser receives product and pays Grower.

Model 2 - Purchaser

The Purchaser has contractual ownership over product.
(One caveat is whether purchasers would take the initiative for the 2011 and 2012 seasons. If not, it may be incumbent upon the FPC to begin to contact purchasers in January, as in other Options)

INPUT/ SCHEDULING
Potential purchasers identify the product and quantity they anticipate purchasing.
Potential purchasers contact potential growers/aggregators and determine how much of the product they anticipate growing. Purchaser and Grower may agree on a contract price.
Grower makes crop plan which reflects the agreed upon product and quantity.
Growers purchase seeds.
Purchaser contacts other value chain entities to schedule aggregation, distribution, processing and/or storage.

GROW/HARVEST
Purchaser maintains ownership over produce.
Growers grow and harvest produce according to certain specifications. For broccoli, in this example, the harvested product should be primarily heads with short stems.

ON-FARM PROCESSING
Purchaser maintains ownership over produce.
Growers undertake primary processing of the produce. This could include cooling the produce to about 40 degrees, sorting, snipping or peeling, packing the produce in bins or boxes.
Growers store, and/or distribute the product under appropriate conditions. For broccoli, product is brought off the field quickly and is stored and shipped at 40 degrees.
Growers deliver an appropriate quantity to the FPC at a specified time. The quantity, quality, temperature, timing and packaging are critical at this stage. For example, 2000

pounds of fresh broccoli heads at 40 degrees packaged in 20 pound boxes delivered before 7 am.
Grower bills Purchaser.

KITCHEN PROCESSING
FPC receives and stores product under appropriate conditions.
FPC processes, packages and freezes product.
FPC bills Purchaser for co-packing services and/or storage.

DISTRIBUTE
Purchaser contracts Distributor, who receives product from FPC.
Distributor delivers product to Purchaser or Storage. If delivered to storage, see below.
Distributor bills Purchaser.

STORE
If delivered to Storage, Storage receives produce and bills Purchaser.

DISTRIBUTE (optional, depending on whether product was in storage)
If product is in Storage, Purchaser contracts Distributor, Distributor receives product.
Distributor delivers product to Purchaser.
Distributor bills Purchaser.

CONSUME
Purchaser receives product.

Model 3 - Food Processing Center

The FPC takes contractual ownership over the product. FPC Purchases produce from the Growers and sells the processed product to the Purchasers.

INPUT/ SCHEDULING
FPC contacts potential purchasers. Potential purchasers identify the product and quantity they anticipate purchasing. FPC and Purchaser may agree on a contract price quantity and quality.
FPC contacts potential growers/aggregators to supply needed quantity and quality. FPC and Grower may agree on a contract price.
Grower makes crop plan which reflects the agreed upon product and quantity.
Growers purchase seeds.
FPC contacts other value chain entities to schedule aggregation, distribution, and/or storage.

GROW/ HARVEST
Growers maintain ownership over produce.

Growers grow and harvest produce according to certain specifications. For broccoli, in this example, the harvested product should be primarily heads with short stems.

ON-FARM PROCESSING
Growers maintain ownership over produce.
Growers undertake primary processing of the produce. This could include cooling the produce to about 40 degrees, sorting, snipping or peeling, packing the produce in bins or boxes.
Growers store the produce under appropriate conditions. For broccoli, product is brought off the field quickly and is stored and shipped at 40 degrees.
Growers deliver or an Aggregator picks up an appropriate quantity to the FPC at a specified time. The quantity, quality, temperature, timing and packaging are critical at this stage. For example, 2000 pounds of fresh broccoli heads at 40 degrees packaged in 20 pound boxes delivered before 7 am.
Grower invoices the FPC, or if an Aggregator is used, see below.

AGGREGATE
Aggregator pick-ups/receives produce, and maintains ownership over produce.
Aggregator pays Grower.
Aggregator may combine multiple Growers' produce.
Aggregator stores the produce under appropriate conditions.
Aggregator delivers produce to FPC at a specified time. Aggregator bills FPC.

KITCHEN PROCESSING
FPC weighs, receives and stores product under appropriate conditions.
FPC processes, packages and freezes product.

DISTRIBUTE
FPC contracts Distributor, who receives product from FPC. Distributor bills FPC.
Distributor delivers product to Purchaser or Storage.
If delivered directly to Purchaser, FPC bills Purchaser. If delivered to storage, see below.

STORE
If delivered to Storage, Storage receives and bills FPC.

DISTRIBUTE (optional, depending on whether product was in storage)
If product is in Storage, FPC contracts Distributor when the Purchaser is ready.
Distributor receives product and bills FPC.
Distributor delivers product to Purchaser.
FPC bills Purchaser.

CONSUME
Purchaser receives product and pays FPC.

Model 4 - Entrepreneur

An entrepreneur launches a business to supply institutions with regionally grown frozen vegetable.

This option could be managed in any way, but most likely would be similar to Model 3, above.

Note that using the shared FPC equipment, several contractual models could co-exist. For example, the FPC could serve as the middleperson, as in model 3, producing frozen product for institutional buyers, while growers contracted with the FPC to co-pack frozen product for CSA distribution or to serve particular markets of their own. An entrepreneur could also launch a business to supply an additional market, such as retail outlets or CSA growers, with frozen products. In addition to the benefits of shared equipment, common use of the FPC facility might also facilitate synergies related to logistical systems, aggregation, and experience.

Distribution

Most medium sized growers own refrigerated trucks that are used to transport fresh produce from the farm to the point of sale. However, the frozen produce value chain creates additional gaps in distribution. Where these gaps fall, and which entity is responsible for addressing the gaps, depends upon the contractual relationships and ownership choices describe above. However, ultimately the cost of distributing the fresh produce to the FPC, moving the frozen produce from the FPC to a storage facility and then to the purchasing institution, must be considered in the overall cost of the product.

Distribution itself can be a complex task. Access to refrigerated trucks and drivers, forklifts or pallet jacks, pallets, appropriate and cost-effective packaging, loading docks, invoicing systems and qualified staff and staff time for each of these operations are critical. Temperature control, again, is vital, as are reliable and consistent pick-up and delivery times. In the last 10 years, these concerns have consistently been listed as barriers for fresh farm-to-school programs, and frozen products add even more complexities[27].

In the 2010 pilot, the grower and the aggregator delivered fresh produce directly to the FPC at a previously scheduled time. FPC staff and the drivers unload the produce at the FPC's loading dock using the pallet jack. Ensuring that fresh produce is delivered at the agreed delivery time is important, as the FPC has limited cold storage space, blocks out other kitchen uses for the day, and hires 5 additional staff. After processing and freezing, the FPC stores the product in its limited freezer storage. In the pilot, the

[27] Joshi, A. et. al. 2007.

purchasing institution owned a refrigerated truck, and had drivers available to pick up the produce in December. Storage needs will depend upon both the FPC's and the institutions' storage capacities, and will be addressed in the Storage section.

The pilot's success can be traced in part to this institution's capacity and willingness to pick up and store the frozen product and the FPC's capacity and willingness to store the product until the institution was ready. In the pilot the costs for these tasks were absorbed by the respective organizations, and the time needed to contract with distributors or storage facilities and coordinate these activities was avoided.

Scaling up the pilot will require a more developed distribution system. Options could include contracting with regional small-scale food distributors, or purchasing a refrigerated truck and hiring a driver, which again may depend on the contractual relationship choices. We interviewed a local distributor to determine the potential cost of contracting the distribution. The FPC is unlikely to purchase a truck, although an entrepreneur may pursue this option.

The distributor interviewed generally aims to charge a 25% gross profit margin on retail frozen goods distribution, and is generally averse to working for a flat fee[28]. The distributor purchases the product from the manufacturer, adds the 25% mark-up, and sells the product to the retailer – thereby taking ownership of the product during the distribution process. The distributor generally takes a minimum $50 delivery for already existing routes.

Given a larger order (for example, 5000 pounds), the distributor might be willing to deliver off this route, but would likely be less willing to take ownership in the same way. In this scenario, the distributor might prefer to set up a per delivery fee, based on the quantity shipped, the distance traveled, and time needed for loading and unloading. The driver would supervise the loading and unloading, but the responsibility for this task is the FPC's or institutions'. The distributor noted that the time for loading and unloading depends quite a bit on the availability of pallet jacks or forklifts, and whether freezer doors are large enough to fit such equipment (if not, boxes need to be carried individually).

The distributor also suggested that for smaller quantities, drayage trucking, where boxes or bins of product from different producers are shipped together, and each producer keeps ownership of their product, might be an option. The drayage charge is predetermined and generally priced by each piece, not by pallet.

The budgetary costs associated with distribution depend upon the contractual model used. Some models require shipping the product more frequently and possibly to a further location. Certain models rely more on third-party distributors than do others.

[28] Personal interview, November 15, 2010.

Other models absorb these costs within existing capacities – for example, a public school with dedicated drivers, refrigerated trucks, and frozen storage. Ultimately, however, the cost of distribution must be factored into the overall cost of the product.

Storage

Once produce is frozen, it needs to be stored and transported in appropriate conditions in order to maintain product quality. CISA and the Food Processing Center are each engaged in active discussions with growers, buyers, cold storage facility operators, and the Food Bank of Western Massachusetts to determine options for expanding cold storage for agricultural products in western Massachusetts. These discussions encompass not only frozen storage, but options for cold storage of crops harvested in the fall and marketed throughout the winter months, as well as other refrigerated and frozen products produced at the Food Processing Center. Different products, of course, require different temperature and humidity levels for optimal storage.

Each of the cold storage options offered above requires large capital expenditures. The costs of cold storage include buildings, coolers/freezers, compressors, electricity, maintenance, forklifts, loading docks, staffing, and transportation. These costs are present at some point in the value chain and more research is needed to determine whether the overall costs can be reduced through specific business and marketing models, centralization, or coordination. For example, if produce is frozen off the farm and returned to the farm for storage, transportation costs are incurred taking the produce back and forth to the processing site, and later, taking the frozen product to market, unless marketing occurs at the farm. If produce is frozen and stored at the processing site, transportation costs are incurred delivering the produce to the processing site and taking the frozen product to market.

An additional complication is the various temperatures and moisture required to store different products. As discussed in the distribution section, above, freezing produce requires cold storage at various stages in various degrees of size and temperature. For example, when produce is picked from the field it needs to be cooled and kept cool prior to delivery to the processing center. This short-term storage may be the same facility as longer-term storage, but often it will be different. New energy efficiency technologies can help reduce the operating costs of cold storage.

Frozen or refrigerated products can be stored at the farm, at the processing facility, at a shared storage facility, or at the purchasing institution. The length and location of storage can affect the price of the final product.

On-Farm

If frozen product will be sold directly from the farm, on-farm storage may make sense. For low-volume needs, such as limited frozen products as part of a winter CSA share, home-scale freezers may provide sufficient and low-cost on-farm storage.

Processing Facility

Although storage needs at the FPC change as businesses using the facility come and go, over the last three years there has been a steady increase in the need for refrigerated and frozen storage. Cold and frozen storage capacity currently includes two 12 x 12 walk-in coolers, one 12 x 12 walk-in freezer, and a temporary shipping container on the loading dock for frozen storage, which is inefficient and expensive. The FPC is actively exploring other options for expanded shared cold and frozen storage.

Third-Party / Shared

Growers in the region are currently exploring off-site cold and frozen storage options. These options include the purchase, rental, renovation or use of existing shared-use cold storage, such as Pioneer Cold in Chicopee. This exploration is primarily focused on storage crops, not frozen products. Off-site storage adds logistical and transportation challenges. As winter market demand expands and more growers need cold storage, off-site storage facilities may adapt their procedures and facilities to better meet the needs of these growers.

Purchasing Institution

Cold storage capacity is limited at most retail outlets and institutional kitchens. Both of these types of buyers are accustomed to receiving regular deliveries of frozen items and turning over stock regularly; most retailers surveyed by CISA, for example received delivery of frozen produce at least once a week. Nonetheless, there are examples of buyers storing additional product in order to access locally-grown product. The public school system that purchased frozen product in the FPC pilot project picked up the product and stored it on-site. This might not be possible, however, if the project grows and the institution receives a greater quantity and variety of frozen products. One retailer interviewed for this project created cold storage for root crops in the basement of her store in order to buy local root crops in bulk to sell throughout the winter. This arrangement did not, however, require significant additional energy outlays, as frozen storage would.

Analysis and Recommendations

Key Findings

Institutional purchasing of regionally grown food has increased rapidly over the past five years. This purchasing is primarily in the form of fresh produce direct from farms to institutions. This study demonstrates that there is similar interest from both farmers and institutions in western New England to increase local frozen produce purchases as

well in order to extend the season for locally grown produce. The supply of many of the desired vegetables is available and the demand continues to grow. There is also evidence from farmers that they could increase the supply if demand at the right price continues to grow. The remaining questions, then, are how the produce can be processed, stored and distributed within the region at a cost that allows a fair price to be paid to the grower and fits within the budget of the institutions.

In our research, we were able to identify key pieces of infrastructure which could help achieve this goal. Processing equipment, storage, distribution, and contracting options are available. While not explicitly stated in each of these options, it is important to remember that primary barriers for farmers entering a new product channel are the associated transaction costs and learning curve[29]. In addition to providing the physical infrastructure required for Extended Season Farm to Institution, this pilot has provided key support for farmers and institutions.

Pilot Recommendation

The pilot project and study, using broccoli as the example, provides evidence that the project can be financially viable within the region, but in order to do so the capacity of the current infrastructure will need to be increased.

- Processing equipment needs to be added to produce larger quantities faster;
- Freezer space needs to be increased to freeze and store more product;
- Refrigerated trucks must be available for distribution;
- Relationships between growers/aggregators, processors and purchasing institutions need to be formalized;
- Ordering and billing systems need to be established;

Therefore, the primary recommendation from this study is to continue to expand the amount of produce frozen by a local processor and to add additional equipment and frozen storage space as soon as possible. It will take time to develop infrastructure and scale up quantity, and the profit margin on frozen produce is modest. Therefore, considering that the priorities of this project are to maintain fair prices for growers and institutions, this project would be most viable if initial capital costs could be supported through grants and low-interest investments.

Given that the Western Mass Food Processing Center has already made substantial investment in key pieces of this infrastructure and management capacity to carry out this endeavor, it may be in the best interest of the region to augment infrastructure at the FPC.

[29] Martinez, et. al. (2010)

Further Research Recommendation

In addition to the recommendations above regarding how best to implement this study's findings in western New England, this study encountered numerous opportunities for further research, including:

- Regionally available supply of certain produce crops, available arable land for expansion, and average wholesale prices for regionally produce.
- Institutions' interests and requirements for a wider variety of products.
- Growers' interests in taking a greater role in the production and distribution of extended season products, and their current capacity for assuming this role, and/ or needed training or technical assistance for assuming this role.
- Ideally scaled systems and infrastructure for the region. For example, at what volume could a regional extended season processing facility best be utilized? What is too big or too small? What billing or product tracking systems are most appropriate? Are there equipment adjustments that could increase processing efficiency?

Glossary of Terms

Aggregators – Businesses which work as intermediaries in the supply chain. Aggregators work with farmers to source and supply vegetables, and with large purchasers such as institutions and grocers. They often perform the tasks of contracting with both parties, picking up and distributing produce, and providing storage for produce.

Growers – Farmers

Processing – In this report, processing is used generally to refer to "light" processing techniques which include freezing and canning. For public schools participating in Child Nutrition Programs, which are encouraged in the Food, Conservation and Energy Act of 2008 to purchase "unprocessed and locally grown…agricultural products," a proposed definition of "unprocessed agricultural products" limits processing techniques. Freezing, vacuum packing, and bagging are included, but cooking and canning are not[30].

Product – Refers to vegetables during and after processing at the FPC

Produce – Refers to harvested vegetables prior to processing at the FPC

Supply Chain vs. Value Chain - While the term "supply chain" refers to the flow of products (in this case, frozen vegetables) from producer to consumer, a "values-based food supply chain, or value chain" indicates an approach to both the movement of the

[30] Martinez, et.al. (2010)

product itself, and the "attributes that traditional supply chains do not typically monitor or promote, such as the environmental and social benefits of producers' practices."[31]

Appendices

Appendix A—Purchaser Product Survey

Appendix B – Purchaser General Survey

Appendix C – Calculation of Weighted Averages

[31] Cantrell, Patty. (2010)

Appendix A – Purchaser Product Survey

	Source	**Package**				**Quantity**				**Frequency**			**Price**
		Vacuum Packed	**IQF**	**Gallon**									**per unit**
	Indicate Fresh Local, Fresh Distributor, Frozen Distributor, or Commodity and Name?	Frozen	Frozen Pieces	Canned, whole	Canned, sauce	2 lbs	5lbs	10 lbs	Other	Weekly	Monthly	Each Semester	
Vegetables													
Artichoke, Jerusalem													
Asparagus													
Beans, Broad													
Beets													
Broccoli													
Brussels Sprouts													
Cabbage													
Carrots													
Cauliflower													
Celery													
Chinese Broccoli													
Chinese Cabbage													
Chinese Spinach													
Eggplant													
Fennel													
Kohlrabi													
Leek													
Winter Squash													
Okra													
Onion													
Parsnip													
Peas													
Pepper													
Potato													
Pumpkin													
Rutabaga													
Snow Peas													
Spinach													
Squash													
Sugar Snap Pea													
Sweet Potato													
Tomatoes													
Turnip													
Zucchini													
Fruits													
Applesauce													
Raspberries													
Blueberries													
Strawberries													
Other													

Appendix B – Purchaser General Survey

Extended Season Farm-to-Institution

2010 Pilot Survey for Institutions
Basic Information

Institution Name	Community served
Food Service Director	Phone
Address	Fax
Email	Website
Other contact names (involved in ordering, menu planning, receiving, etc)	Are you interested in buying locally grown value-added foods (frozen, canned, etc)
# of food prep sites	# of dining sites
Dining Services Information	
Regular School Year	# of breakfasts served per day
# of lunches served per day	# of dinners served per day
Summer	# of breakfasts served per day
# of lunches served per day	# of dinners served per day
What fruits or vegetables do you purchase frozen?	What fruits or vegetables do you purchase canned/ jarred?
Please use attached product list*	Would you be interested in promoting or marketing your use of locally grown and processed food?

Order/ Purchase/ Delivery Information	
Are there other processed or unprocessed local products in which you would be interested?	How frequently do you have frozen/ canned products delivered?
How do you prefer to place orders?	How often do you order (is there a specific day)?
What time of year would you prefer to purchase local value-added products?	If ordering over the summer for fall/ winter delivery, do you have any flexibility with volume?
When is your demand highest? What months?	How are items packaged?
What are your procurement procedures?	What are your payment procedures?
Where, what day, and what time do you take deliveries?	If another staff handles deliveries, invoicing, and payments, please provide name, email, phone, and fax.
How would you prefer to receive the product?	Do you have a frozen/ refrigerated truck?
Do you have freezer space for large quantities? When? How much?	Are you willing to pay a periodic surcharge for frozen storage?
Can your kitchen and staff accommodate other packaging? (ie, 5 gallon plastic buckets, 40 lb boxes, etc.	Would you be able/ interested in reusing boxes or 5 gallon plastic buckets?
Are you interested in organic products?	Are you willing to pay a premium for organic products?

2010 Pilot Participants	
Did your institution purchase frozen or canned local produce processed at the Western Mass Food Processing center in 2010?	Yes No
If yes, (If no, please continue to the next page) How did the 2010 Extended Season Farm-to-Institution Project compare to similar products you have used in the past? Please rate, on a scale of 1 to 5, with 1 indicating that the FPC product is "Unfavorable" and 5 indicating that the FPC "Favorable."	FPC Farm-to-Institution Product is Unfavorable Favorable to comparative products
We were able to order the selection of vegetables that we need.	1 2 3 4 5
We were able to order the quantity of vegetables that we need.	1 2 3 4 5
The vegetables that we need were available in the state we need. (frozen, canned, coined, chopped etc).	1 2 3 4 5
The packaging protected the product from damage.	1 2 3 4 5
The packaging was convenient for our staff & kitchen's needs and tools.	1 2 3 4 5
The packaging was convenient for our storage space and transport equipment.	1 2 3 4 5
The product was high quality.	1 2 3 4 5
The cost was appropriate.	1 2 3 4 5
Delivery process was smooth.	1 2 3 4 5
Delivery was reasonably priced.	1 2 3 4 5
Storage was adequate.	1 2 3 4 5
Storage was reasonably priced.	1 2 3 4 5
We felt comfortable with the safety of the product.	1 2 3 4 5
We felt comfortable with the traceability of the product.	1 2 3 4 5

If not, why? (Please check as many as apply)	____ No product available ____ Wrong products available ____ Not enough product ____ Right vegetable, wrong processing ____ Packaging ____ Concerns about quality ____ Concerns about cost ____ Concerns about delivery ____ Concerns about storage ____ Concerns about food safety ____ Concerns about traceability ____ Did not know about this Project ____ Other. Please Explain:
Please provide any feedback regarding your experience with this project:	

Appendix C – Calculation of Weighted Averages

2005-2009 New England Agricultural Statistics, NASS, USDA Fruits and Vegetables, May 18, 2010					
	Crop	Number of Reports	Yield per Acre (pounds)	Estimated Yield	Weighted Average 2005-2009
	Beans, Snap				
CONNECTICUT					
MASSACHUSETTS					
	2005	17	2800	47600	
	2006	26	3000	78000	
	2007	26	5000	130000	
	2008	25	3700	92500	
	2009	25	3700	92500	
		119	18200	440600	3703
NEW HAMPSHIRE					
	2005	9	4300	38700	
	2006	19	2500	47500	
	2007	11	4500	49500	
	2008	12	2600	31200	
	2009	20	2600	52000	
		71	16500	218900	3083
RHODE ISLAND					
	2005	D	D		
	2006	D	D		
	2007	D	D		
	2008	D	D		
	2009	D	D		
VERMONT					
	2005	14	3500	49000	
	2006	15	2700	40500	
	2007	8	3500	28000	
	2008	10	2900	29000	
	2009	D	D		
		47	12600	146500	3117
TOTAL Mass, NH, RI, VT Yield /Acre Weighted Average					
		237		**806000**	**3401**

	Crop	Number of Reports	Yield per Acre (pounds)	Estimated Yield	Weighted Average 2005-2009
	Broccoli				
CONNECTICUT					
MASSACHUSETTS					
	2005	7	2650	18550	
	2006	D			
	2007	12	2400	28800	
	2008	10	3250	32500	
	2009	15	2000	30000	
		44	10300	109850	2497
NEW HAMPSHIRE					
	2005				
	2006				
	2007				
	2008	7	4000	28000	
	2009				
		7	4000	28000	4000
RHODE ISLAND					
	2005	D	D		
	2006	D	D		
	2007	D	D		
	2008	D	D		
	2009	D	D		
VERMONT					
	2005	5	6200	31000	
	2006	D	D		
	2007	D	D		
	2008	D	D		
	2009	D	D		
		5	6200	31000	6200
TOTAL Mass, NH, RI, VT Yield /AcreWeighted Average					
		56		**168850**	**3015**
	Crop	Number of	Yield per Acre	Estimated Yield	Weighted Average

		Reports	(pounds)		2005-2009
	Cauliflower				
MASSACHUSETTS					
CONNECTICUT					
	2005	D	D		
	2006	7	7700	53900	
	2007	16	7400	118400	
	2008	D	D		
	2009	D	D		
		23	15100	172300	7491
NEW HAMPSHIRE					
	2005	D	D		
	2006	D	D		
	2007	D	D		
	2008	D	D		
	2009	D	D		
RHODE ISLAND					
	2005	D	D		
	2006	D	D		
	2007	D	D		
	2008	D	D		
	2009	D	D		
VERMONT					
	2005	D	D		
	2006	D	D		
	2007	D	D		
	2008	D	D		
	2009	D	D		
TOTAL Mass, NH, RI, VT Yield /AcreWeighted Average					
		23	15100	172300	**7491**
	Crop	Number of Reports	Yield per Acre (pounds)	Estimated Yield	Weighted Average 2005-2009
	Pepper, Bell				
CONNECTICUT					
MASSACHUSETTS					

	2005	29	17000	493000	
	2006	42	16600	697200	
	2007	40	32300	1292000	
	2008	24	15300	367200	
	2009	36	11700	421200	
		171	92900	3270600	19126
NEW HAMPSHIRE					
	2005	6	8100	48600	
	2006	12	7600	91200	
	2007	12	5000	60000	
	2008	D	D		
	2009	D	D		
		30	20700	199800	6660
RHODE ISLAND					
	2005	D	D		
	2006	D	D		
	2007	D	D		
	2008	D	D		
	2009	D	D		
VERMONT					
	2005	D	D		
	2006	D	D		
	2007	7	17000	119000	
	2008	7	2900	20300	
	2009	7	11400	79800	
		21	31300	219100	10433
TOTAL Mass, NH, RI, VT Yield /AcreWeighted Average					
		222		**3689500**	**16619**

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