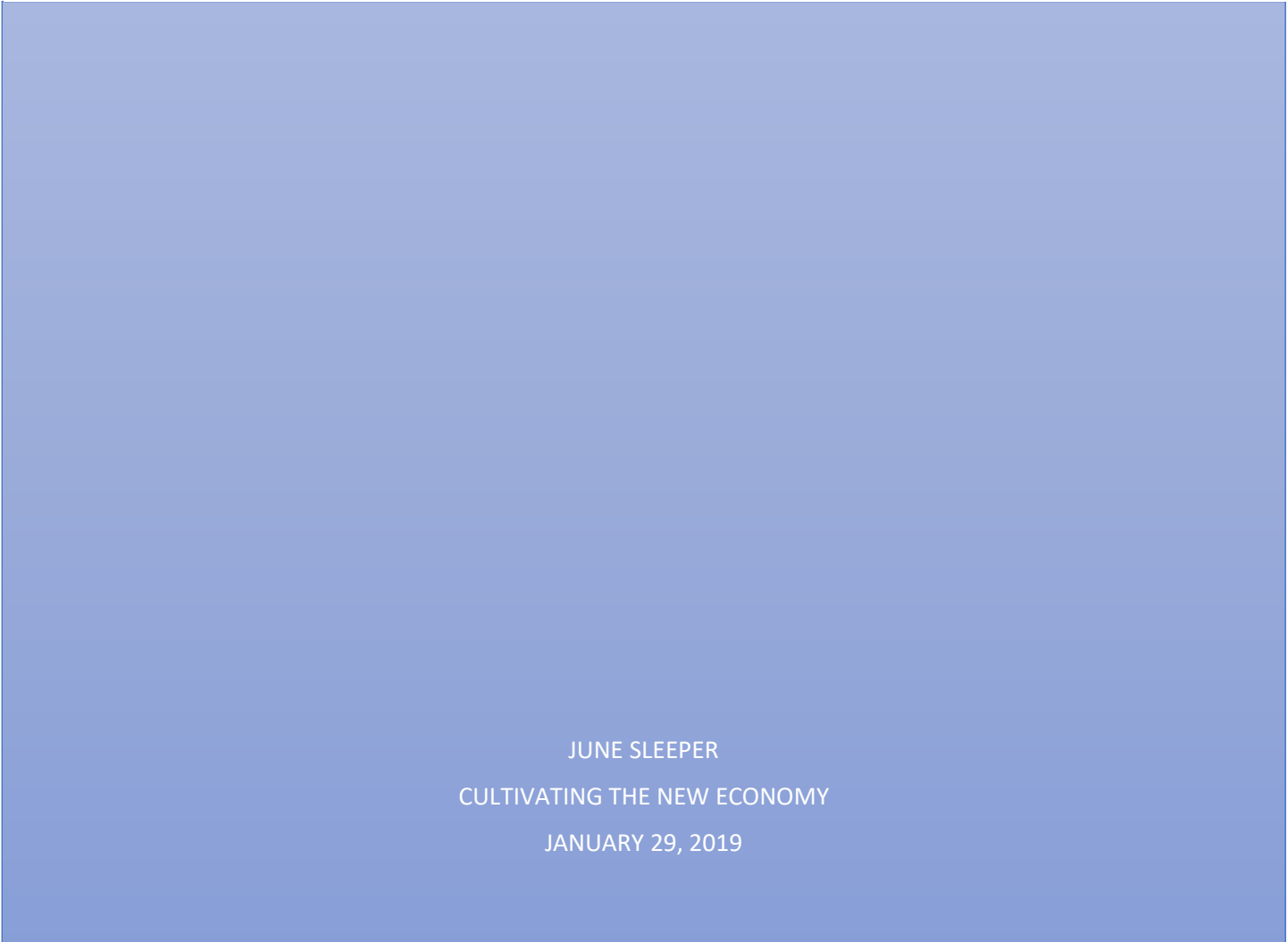




PRIMER: MAINE'S FOOD PROCESSING & MANUFACTURING LANDSCAPE

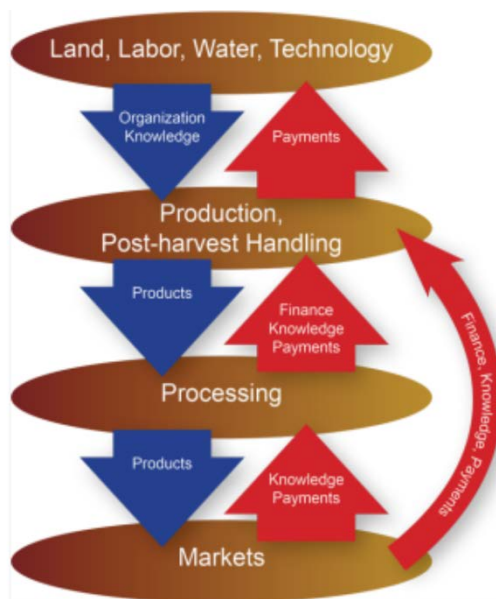


JUNE SLEEPER
CULTIVATING THE NEW ECONOMY
JANUARY 29, 2019

EXECUTIVE SUMMARY

The purpose of this primer is to establish a foundation that provides common knowledge to facilitate effective communication as the project stakeholders collaborate on the development of Maine's Premium Foods Manufacturing Value Chain. To gain a comfortable viewpoint of Maine's food production system a brief review of the key areas shown below will be presented prior to a review of systems in place elsewhere. The basic building blocks included are in an abbreviated format, and the opportunity to explore more detail is included in addendums.

- Terminology common to the food manufacturing industry
- Overview of Maine's regulatory structure
- High-level look at the seasonality of land and sea based vegetables and seafood
- Co-packers in Maine
- Co-location potential
- Case Studies & Programs
- Pilot Plants
- Review & Recommendations



With this foundation in place it is interesting to consider Devex's statement that a value chain approach in agricultural development helps identify weak points in the chain and actions that can add more value. With a focus on agriculture in developing countries they have observed dual value chains operating in parallel for the same product: one informal or traditional, and the other formal or modern.¹ Small agriculture-based businesses are frequently involved in informal chains whose products stay in the local economy, while larger farms and organized groups are engaged with supermarkets and the export trade.

This mirrors the challenge seen in Maine and elsewhere in the United States, and so we can look to others for examples of how to successfully expand our geographical reach and increase traded jobs in the region. Becoming a producer of high quality, food products within agriculture and aquaculture will require the improvement of value chains. Known for being at the end of the road, Maine is also known for the persistence of its people, and that combined with strategic support will enable remarkable changes to occur in its food industry.

TERMINOLOGY

Shown below is an abbreviated list of terms and processes common to the food manufacturing industry. Producers, manufacturers and government agencies are focused upon a safe food supply at every step of the way to insure that consumers are not exposed to bacteria and contaminants that can cause serious illnesses. The view presented here is intended as a warm up to the detailed dictionary which is provided as a reference tool in Addendum A.

TERMINOLOGY/PROCESS	ABBREVIATED DEFINITION
Acidified food	Product with a natural pH of 4.6 or below.
Blanching	Prepackaging heat treatment of foodstuffs for a sufficient time and at a sufficient temperature to partially or completely inactivate naturally occurring enzymes.
Blast chiller	Refrigeration unit that chills foods from 60° to 3°C in 90-120 minutes or less.
Canning	Process by which a food product is enclosed in a sterilized container totally impervious to microbes and heated until all microorganisms inside the container are killed.
Chilling and Freezing	Bacteria and yeast grow best at specific temperatures, usually between 40 F to 140 F. By lowering the temperature below 40 F their metabolic and reproductive action is significantly slowed.
Cold pack	Canning procedure in which jars are filled with raw food.
CAP (Controlled Atmosphere Packaging)	CAP is defined as packaging of a product in a modified atmosphere followed by maintaining subsequent control of that atmosphere.
Cook-Chill Process	A process that uses a plastic bag filled with hot cooked food from which air has been expelled and which is closed with a plastic or metal crimp.
Dehydration	Modern methods of dehydration use circulating air that is heated just enough to promote dehydration without "cooking" the food.
Fermentation	Fermentation itself is a form of food spoilage, but when the microorganisms are tightly controlled, it can produce desirable effects and provide safeguards against harmful organisms.
GMPs (Good Manufacturing Practices)	System of ensuring a safe environment in which to carry out the processing of food.
HACCP (Hazard Analysis Critical Control Point)	System based on science and logic which identifies potential biological, chemical and physical hazards in food production and establishes preventative measures for their control and to ensure nothing to affect the safety of the product happens at these points.
Heat processing	Treatment of jars with sufficient heat to enable storing food at normal home temperatures.
Hot Pack	Heating of raw food in boiling water or steam and filling it hot into jars.
IQF (Individually quick frozen)	Involves sending the individual food items on a sort of conveyor belt into a blast chiller that freezes the item very quickly. Because the food items are separate when they go in, they stay separate after they've been frozen.
Low-acid foods	To control all risks of botulism, jars of these foods must be (1) heat processed in a pressure canner, or (2) acidified to a pH of 4.6 or lower before processing in boiling water.
MAP (Modified atmosphere packaging)	Methods that will help to maintain the quality of a food product by changing the atmosphere inside its retail package.
Pasteurization	Traditionally, this term has been applied to thermal processes but it can also refer to emergent alternative technologies with the purpose of pathogens inactivation.
ROP (Reduced Oxygen Packaging)	The term, ROP, can be used to describe any packaging procedure that results in a reduced oxygen level in a sealed package.
Traceability	Ability to trace the history, application, or location of an entity by means of recorded identifications.
Vacuum packaged	Food is placed in an air-tight package and all the air removed prior to sealing to prevent growth of microorganisms.

MAINE'S REGULATORY FRAMEWORK

The Maine Department of Agriculture is actively engaged in supporting and maintaining a safe food system for its citizens. It does this by handling specific contracted inspections for the USDA & FDA and insuring that stipulated safety requirements are adhered to.

The following tables depict the agencies responsible for inspections by product group, and the relevant safety regulations. More details are included for the major groups and a section included that presents an overview of The Department of Agriculture's permits and licensing.

REGULATORY FRAMEWORK

PRODUCT	INSPECTION RESPONSIBILITY for		INTERSTATE SALES ALLOWED with DACF Inspection	SAFETY REQUIREMENTS			
	Interstate Food Sales	STATE INSPECTION RESPONSIBILITY for Intrastate Food Sales		FSIS	CGMPs	HACCP	
MEAT(DOMESTICATED)	USDA	MAINE DACF	YES	FSIS	CGMPs	HACCP	
POULTRY(DOMESTICATED)	USDA	MAINE DACF	YES	FSIS	CGMPs	HACCP	
PROCESSED EGGS(liquid pasteurized) & PROCESSING PLANTS	USDA	N/A	YES	FSIS	CGMPs		
MEAT(DOMESTICATED) SLAUGHTER & PROCESS	USDA	MAINE DACF	YES-COOPERATIVE INTERSTATE SHIPMENT (CIS)/ LIMITED TO SPECIFIC STATES		CGMPs	HACCP	
POULTRY(DOMESTICATED) SLAUGHTER & PROCESS	USDA	MAINE DACF	YES-COOPERATIVE INTERSTATE SHIPMENT (CIS)/ LIMITED TO SPECIFIC STATES		CGMPs	HACCP	
SEAFOOD PROCESSING	FDA	MAINE DACF	YES		CGMPs	HACCP	
PRODUCE SAFETY	FDA	MAINE DACF	YES	PC FSMA	CGMPs		
DAIRY PRODUCTS(w/out eggs: yogurt, cheese, ice cream, sour cream)	FDA	MAINE DACF	YES	PC FSMA	CGMPs		PMO
DAIRY (milk)	FDA	MAINE DACF	YES*	PC FSMA	CGMPs		PMO
DAIRY (processed)	FDA	MAINE DACF	YES	PC FSMA	CGMPs		PMO
SHELL-ON-EGGS(eggs w/addl ingredients added) & PROCESSING PLANTS	FDA	MAINE DACF	YES	PC FSMA	CGMPs		
PROCESSED FRUIT & VEGETABLE	FDA	MAINE DACF	YES	PC FSMA	CGMPs		
GRAIN FACILITIES STORAGE/TRANSPORTATION/MILL	FDA	MAINE DACF	NO	PC FSMA	CGMPs		
PROCESSED JUICE/Cider	FDA	MAINE DACF	YES**	PC FSMA	CGMPs	HACCP	
TRANSPORTATION	FDA	MAINE DACF	YES	PC FSMA	CGMPs		
FOOD FACILITY REGISTRATION	FDA			PC FSMA			
RETAIL		MAINE DACF or HIP/DHHS	NO***				FOOD CODE

* No raw milk distributed out of state

** If DACF inspects a facility for initial licensing, DACF would not restrict their distribution, but advise them of the FDA requirements. No interstate sales of unpasteurized cider.

*** A retail facility could engage in interstate sales if they have a food processor license with DACF.

SAFETY REQUIREMENTS

SAFETY REQUIREMENTS		
USDA	FSIS	Food Safety and Inspection Service
USDA/FDA	HACCP	Hazard Analysis and Critical Control Points
FDA	FSMA	Food Safety Modernization Act
USDA	CGMP'S	Current Good Manufacturing Practice
FDA	PMO	Pasteurized Milk Ordinance
HIP/DHHS	FOOD CODE	Health Inspection Program and Department of Health and Human Services (Maine)
FDA	PC FSMA	Preventative Controls for Human Foods Food Safety Modernization Act

Meat & Poultry

Amenable livestock (domesticated meat) consists of all cattle, sheep, goats, swine, and equines. These species are regulated and must be inspected in accordance with the USDA's Food Safety and Inspection Service (FSIS) requirements. Non-amenable species are not covered by the inspection program. This includes mammals such as reindeer, elk, deer, antelope, water buffalo, bison, squirrel, opossum, raccoon, rabbit, nutria (semiaquatic rodent) and muskrat. Non-aquatic reptiles such as land snakes are also considered to be non-amenable and do not require inspection per FSIS.

Poultry considered to be an amenable species, whether live or dead, consist of: chickens, turkeys, ducks, geese, guineas, ratites, and squabs. Also, ratites (ostrich, emus, and rhea) were recently added to the list of amenable (domesticated) poultry species. All of the birds listed fall under the jurisdiction of the USDA and FSIS regulations.

Guidelines for the slaughter and processing of meat and poultry are considerably different and should not be comingled. The fundamental specifications for building layouts, processes and sanitation are complex and compliance is paramount to ensure a safe food supply. The USDA & FDA issue guidance^{2,3} on requirements that must be met and maintained in for those engaged in these businesses. In addition to their official websites, The American Association of Meat Processors⁴ offers a variety of publications to gain appreciation and depth of knowledge.

Seafood

The FDA operates a mandatory safety program for all fish and fishery products under the provisions of the Federal Food, Drug and Cosmetic (FD&C) Act, the Public Health Service Act, and related regulations. The FDA program includes research, inspection, compliance, enforcement, outreach, and the development of regulations and guidance. An extensive compilation of the most up-to-date science and policy is published by the FDA. The documents are focused upon hazards that affect fish and fishery products and effective controls to prevent their occurrence.⁵

Produce

The Produce Safety rule establishes science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption. The rule is part of the agency's ongoing efforts to implement the FDA Food Safety Modernization Act (FSMA). The FDA has announced that routine inspections associated with the Produce Safety rule will not begin until the spring of 2019 to allow time for more guidance, training, technical assistance, and planning.

Dairy

Maine's dairy processing industry is provided with State regulated and FDA certified inspection of their products, and State certification of their analysts which allows them to sell milk across state lines and within the State. The Dairy Inspection Program is responsible for inspecting processors and farms to ensure the safe supply of milk for the public. The Dairy Inspectors conduct farm and dairy plant inspections in compliance with the Interstate Milk Shippers Program (IMS). They visit dairy farms semiannually for sanitary inspections of milking equipment and facilities.⁶

PERMITS & LICENSING

In addition to inspection programs, The Maine Department of Agriculture is also responsible for the oversight of permits and licensing. Working in unison with Maine and Federal Liquor Licensing agencies to oversee beer and wine distillates.

MAINE DEPT OF AGRICULTURE QUALITY ASSURANCE	
PERMITS & LICENSING	INSPECTION PROGRAMS
Dairy Licensing	Federal/State Inspection Service
Rotation Crop	Consumer Food Inspection
Potato Dealers	Red Meat and Poultry Inspection
Dry Bean Dealers	Poultry and Egg Grading
Blueberry Processors and Packers	Fruit and Vegetable Inspection
Controlled Atmosphere Apple Storage	Dairy Inspection
Seed Labeling	
Commercial Feed Products	
Pet Foods	
Food Establishments	
Beverage Plants	
Home Food	
Maple Syrup Processing	
Cider/Apple Juice Plants	
Domesticated Deer	
Bakery	
Food Processing	
Food Salvage	
Retail Food	
Food Storage Warehouse	
Mobile Vendor	
Beer and Wine Distillates	

SEASONALITY

Shown below is a rolled-up view of the growing season for Maine’s major food groups based upon data from *Get Real Get Maine* and the *Maine Sea Grant 2014*. Granular versions are provided in Addendum B.

In general, we can assume that volumes of most vegetables can be available for processing, in some manner, towards the end of the growing season.

Fin fish are generally available year-round, with April through September being the peak season. Shellfish have more variability, with harvest time and season length stipulated by the Department of Marine Resources (DMR). Dairy, meat, and poultry are available for almost the entire year since Maine’s climate does not have a significant impact.

PRODUCT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
DAIRY												
MEAT												
POULTRY												
GRAINS												
FRUIT												
VEGETABLES												
Spring/Summer												
Autumn(Root)												
FIN FISH												
CLAMS												
LOBSTERS												
MUSSELS												
SCALLOPS												
OYSTERS												

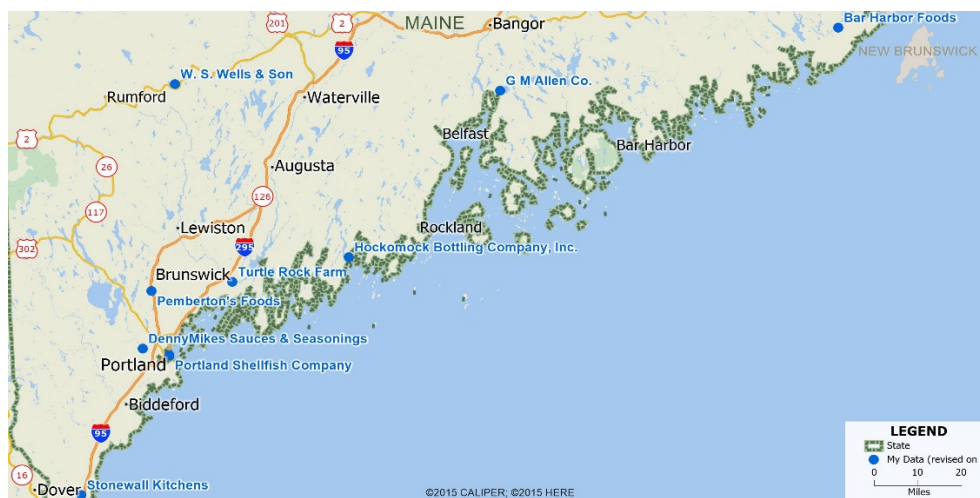
CO-PACKERS

Co-packers manufacture and package foods for other companies to sell and may range from nationally-known brands to private labels. A variety of services will likely be offered, but are dependent upon the size and experience of the co-packer as well as the capacity and type of facility that they operate.

Using a co-packer can be advantageous to the food entrepreneur as they reduce startup costs as the capital involved in building and outfitting a facility can be enormous. A co-packer can offer a more accurate budgeting perspective of overhead due to their experience in manufacturing. Lead-time to get product to market can be reduced by working with a co-packer with similar lines and the complexity involved in manufacturing, packaging, and labeling can be mitigated as well. The path to compliance with regulatory and safety issues, procurement, insurance, testing will be expedited and contacts in the food industry will allow for more targeted marketing and logistics efficiencies.

There are potential disadvantages to using a copacker too, beginning with the loss of control over the product during the manufacturing process. An entrepreneur will need to be amenable and in alignment with the co-packer's production schedule, fixed costs and methodologies. There may also be confidentiality issues to consider as formulations, ingredients and product specifications must be shared with the co-packer. Sometimes it is necessary to share customer and sales information, and while agreements may provide some protection, confidentiality can never be 100% assured. Finally, the cost for using a co-packer may be higher than anticipated and leave the entrepreneur with a lower profit margin than anticipated.

Maine Co-Packers



Pemberton's Foods—Gray, Maine

Co-packer & Private Label Manufacturer specializes in producing jams, jellies, grilling sauces, salsa, pasta sauce, pesto and dessert toppings

- Manufacturing
 - 12,000 square foot facility
 - Licensed FDA facility
 - Focus on all-natural products/Certified Organic facility
 - Acidified foods/Pasteurized/Bottled & Sealed
 - Hot-fill, shelf-stable products

- Cold-fill, fresh refrigerated products
- Production Consulting
 - UPC procurement, test batches, shelf life testing, nutritional analysis, label consulting, recipe scaling

DennyMike’s Sauces & Seasonings—Westbrook, Maine

Wheat-Free, Nut-Free Production and Co-Packing Operation focused on shelf-stable, dry ingredient products

- Manufacturing
 - 10,000 square foot facility
 - HAACP (USDA & FDA)
 - Equipped with a tumble blender, filler unit, bag sealer and shrink tunnel
 - Ready to fill: packets, tins, bags, bottles and bulk containers
- Production Consulting
 - Insights, recommendations, advice and coordination of services for label and logo design, lab analysis and packaging

Turtle Rock Farm—Brunswick, Maine

Contract Packaging for small to mid-size farmers offering value added local goods. Kitchen is available to rent Saturday through Monday year-round.

- Private label – They provide their recipes in their jars with your label for you to market as your own. This is geared more towards farm stands, event hosts or local grocers while some farms also take advantage of this offering where they will simply plug in their own crop (blueberry for example) and utilize their pre-approved and market tested recipes.
- Contract packaging - Bring your recipe, your produce, and they manufacture the product for you to market as your own. Turtle Rock Farm will provide licensing and regulation compliance and design if needed.
- Recipe and product development - Use with your produce or your idea and they create a product for you and steward it through the process to bring to market, that will lead to a final product that Turtle Rock will manufacture and you market as your own.

CO-LOCATE

A basic definition of co-locate refers to the practice of locating multiple similar businesses in the same facility. For the purpose of this primer, ‘similar’, refers to those that may use some of the same types of food processing equipment and processes, storage facilities, and transportation. To expand upon this further for food and beverage related businesses, we may see complementary firms in close geographical proximity, like those that are found in food clusters and innovation districts. Whichever label is used, the focus should be upon the potential to create competitive advantages when interrelated food business are co-located, externalities (e.g., demand, supply, employment, technology, etc.) linked and individual businesses are mutually benefited by the success of others.⁷

CO-LOCATION – OPPORTUNITY FOR OPTIMIZATION

Ocean Approved (OA) is located in Saco and its primary business is focused on value-add processing of kelp grown in Maine. Freshly harvested kelp is lightly processed by cutting, blanching and freezing on site. Their finished products may take the shape of smoothie cubes, seaweed slaw, or Maine's Own Seaweed Salad™. OA's expanding product line is gluten free, paleo-friendly, vegetarian, macro-friendly, free of food coloring, MSG and preservatives.

100% of their kelp is sustainably farmed in Maine, then processed and frozen in their 8,000 square foot, state of the art facility. Like land-based vegetables, this sea vegetable is farmed and harvested on a seasonal basis. The initial processing and freezing phase must be executed shortly after harvesting in order to ensure that high quality is maintained. Kelp is a unique vegetable in that it may go through multiple freeze/thaw cycles with no impact to the quality of the final product. This is essentially an extension of season which enables OA to stretch out its final processing. Having the ability to 'time' production translates to a flexible system that allows OA to rent their facility to businesses whose production needs offset their own schedule and thereby increase cash flow.

OA demonstrated this flexibility in 2018 when they rented their facility to a New England fishmonger to process its daily catch. These two companies have been successfully sharing the processing facility due to consistency, predictability and complementary schedules. OA also engaged in a short-term rental of their facility to a USDA LFPP Grant project team piloting the sale of land-based vegetables that were lightly processed, packaged, and frozen at their plant in Saco. Discussions with OA's management team has highlighted the importance of engaging with businesses that have been well vetted and have the capacity to maintain a professional relationship. Having industry knowledge and process experience is important, and compliance with safety guidelines and sanitation protocols (HAACP) must be strictly adhered to so that there is no opportunity for cross-contamination of food products.

This type of co-location arrangement has the potential to positively impact seasonal businesses like Ocean Approved in several ways. Facility and equipment utilization are increased and the rental fees realized positively impact cash flow. Also, there is potential to build the workforce by developing a program to cross-train employees for various types of processing, increase the number of labor hours available, and mitigate the need for using temporary staffing agencies and untrained workers. Ultimately, revenue is increased and costs associated with labor should be decreased.

CASE STUDIES & PROGRAM REVIEWS

VERMONT

Vermont-Farm to Plate

Vermont has been recognized for the development of the most comprehensive statewide food system plan in the US, and the first of its kind in the New England region. The Vermont Sustainable Jobs Fund (VSJF) is a 501(c)(3) nonprofit organization created by the Vermont Legislature in 1995 to partner with state government, private sector businesses, and nonprofits to build a thriving economic, social, and ecological future for Vermont. In 2009, Farm to Plate Investment Program legislation was signed into law and the VSJF created a ten-year strategic plan to: 1) increase economic development in the farm and food sector, 2) create jobs in the farm and food economy and 3) improve access to healthy local food.

The Farm to Plate Network is responsible for implementing the 25 Farm to Plate goals of Vermont's food system plan and advancing its own organizational goals. The Network encompasses farms, food production businesses, specialty food producers, educational institutions, nonprofit organizations, capital providers and government. Its members work on high impact projects to re-localize the food system, assess gaps, opportunities, and trends and monitor progress towards reaching state-wide goals.⁸



Vermont's Farm to Plate program and strategies are ambitious and significant progress has been made towards reaching their goals. But there are some who feel that more needs to be done to prevent and reverse the overall trend and drop in Vermont's agricultural activity due to a massive loss of active farm operations and a trend towards smaller acreage farm models. This group believes that an increased commitment to some of the current strategies, in combination with new ones are necessary going forward.⁹

Vermont Food Venture Center

The Center for an Agricultural Economy (CAE) owns the Vermont Food Venture Center (VFVC), a shared use food hub and business incubator designed for food entrepreneurs and farmers seeking to grow their business. CAE is a non-profit organization based in Vermont's Northeast Kingdom. CAE operates the VFVC and works with farms in all stages of development. Three major funders made this effort possible; the Town of Hardwick, the Vermont Housing and Conservation Board, and the EDA. It supports job creation, strengthens value-added food businesses, creates opportunities for farmers, and further integrates the agricultural economy into the community and the state of Vermont.

A shared use processing facility and business incubator designed for food entrepreneurs and farmers seeking to grow their businesses. The 15,000 sq. ft. building has three state-of-the-art, shared-use commercial kitchens that are available for rent to food entrepreneurs, farmers, and community groups. Consulting services are offered for: 1) Branding/Marketing, 2) Production Scale Up, 3) Sourcing, Packaging, and Distribution, 4) Food Safety Regulations and Training, and 4) Client Guidance.

The CAE moves local produce to institutional markets. They aggregate and process root and storage crops. CAE acts as a food hub and processor with Vermont farms and institutional buyers, coordinating with local distribution partners to move products across New England. The Farm to Institution program has two overarching goals:

- 1) To provide a fair price to farmers, pay in a timely fashion, and aim to diversify their markets into institutional food service settings
- 2) To work with values-based institutional buyers, to help leverage their buying power to support working landscapes, and to reach the constituents and consumers who eat in their cafeterias and dining halls.¹⁰

Mad River Food Hub

The Mad River Food Hub (MRFH) project was initiated in 2010, and began operating in 2012. Located in Waitsfield, VT the facility offers the opportunity to process, store, and distribute food. The services and opportunities made available, but this first-of-its-kind facility in New England, was designed with the capacity to process meat, vegetables and herbs, all on one site.¹¹ Establishing the MRFH was accomplished with a combination of funds raised through federal and state grants, foundation funds, private investments, and donations.

The MRFH is a 4,000 sq. ft. fully equipped, food processing and storage plant that is shared by food processing and agricultural businesses to reduce costs. It enables local small farmers to process and preserve their products and get them to market, and several local companies have relocated their operations to the site. Distribution services are available and training is available for those interested in meat production, value added processing, and safety regulations. The facility has a meat processing license from the VT Agency of Agriculture, a food processing license from the VT Department of Health, and is USDA certified for vegetable processing. The plant, which is available for rent, has: an industrial size cooler, freezer rooms, dry storage, 2 meat processing rooms, vegetable processing room, smoke room, kitchen equipment and a shared dish station.

Marketing is addressed by *Mad River Taste*, a local program supporting the makers and growers located in the Mad River area. This program mitigates the producers lack of experience and time available to properly market their products. This centralized effort has enabled outreach and education to new customers, as well as the ability to promote products inside Vermont and outside of its borders.¹²

MASSACHUSETTS

Western MA Food Processing Center

The Western Mass Food Processing Center (WMAFPC) was launched in 2001 to promote economic development through entrepreneurship, provide opportunities for sustaining local agriculture, and promote best practices for food producers. This was accomplished with the assistance of Franklin County Community Development Corp., whose executive director, John Waite, secured funding from various sources to create a commercial kitchen and a warehouse and distribution facility that forms the core of the WMAFPC.¹³

The 24-hour, secure access, production facility is fully equipped and meets federal, state, and local standards. In addition to vegetable wash and process areas and a complete sanitation program, it is outfitted with steam jacketed kettles, semi-automatic hot-bottling/filling equipment, large capacity mixers, coppers, and shredders for processing. Label applicators, storage (dry, cold and frozen), shipping and receiving area, shared office space and equipment are also available.

The WMAFPC operates as a business incubator providing assistance with and guidance to bring a product to market. Services that cover critical business needs are available like:

- Product Feasibility, Prototyping and Commercial Process Development and Scale Up
- Business Planning
- Rental Production Space: Support and training for agricultural producers and growers making value-added products or preserving harvests for retail and wholesale. The facility supports bottled and shelf-stable prepared foods, acidified foods, fresh-pack, and IQF freezing.
- Licensing Navigation and Support
- Marketing Support
- Distribution Support
- Fully developed and implemented GMPs and SOPs with Certified PCQI (Preventive Controls Qualified Individual-aka FSMA) on site.
- Retail Operations: Facilities and support for catering, special events, mobile food service, and other direct-to-consumer food production.
- Co-pack Solutions: Assistance with the production of commercial quantities under an entrepreneur's label.

In 2009, the WMAFPC launched the *Extended Season* program in order to increase the region's capacity to lightly process fruits and vegetables (freezing and canning). With assistance from The Community Foundation of Western Massachusetts, CISA, MDAR, and USDA Rural Development, new efficient equipment specifically designed for freezing fruits and vegetables was purchased and installed. This was done with the anticipation of freezing up to 100,000 lbs. of regional produce for schools and hospitals annually. They worked closely with farmers, wholesale distributors, and retail procurement personnel to develop a regional value-chain for frozen and canned products that offers a fair price to farmers and a competitive price to purchasers.¹⁴

MICHIGAN - FOOD INNOVATION DISTRICT

Michigan State University (MSU) is central to the advancement of the Food Innovation District. Their mission is to engage the people of Michigan, the US and the world in applied research, education and outreach to develop regionally integrated, sustainable food systems. They believe in collective impact: the idea that complex social problems are best solved when organizations in diverse sectors actively commit to a common agenda. To this end, they function as a collective impact “backbone organization”, convening partners across the state to promote food that is healthy, green, fair and affordable.

In 2012, MSU established The Center for Regional Food Systems to advance regionally rooted food systems through applied research, education, and outreach. They are continuing to partner with people and organizations advancing healthy, green, fair, and affordable food systems. A network convener, they support collaboration, and provide technical assistance, research, and information. Responding to emerging needs in the good food value chain and proactively working to establish new trends that meet changing contexts.

MSU held a ground-breaking ceremony for The Food Processing and Innovation Center (FPIC) in 2017, a first of its kind in the nation.¹⁵ It will be Michigan’s leading independent commercial food development, processing, packaging and research facility. Providing a real-time production environment to support the creation of new food products. The facility will be a hub for the food processing industry throughout the state and be involved with commercial product innovation, regulatory and workforce development training,

The FPIC is a multi-functional leasable processing plant with the flexibility to enable an entrepreneur to explore options for processing and packaging to suit existing products or experiment with new formulations. The FPIC has a modular design and dedicated production zones that maximize the efficiency of the space and allow the line to easily connect to main fixed components like a retort, spiral oven, spiral freezer, and bottling line. The facility also has storage (dry, cooler, freezer), a dock for shipping and receiving, on-site processing and packaging expertise.

With funding provided by the USDA and Northwest Michigan Council of Governments (now Networks Northwest), MSU worked together with project partners and stakeholders throughout Michigan to prepare *‘Food Innovation Districts: An Economic Gardening Tool’* that communities nationwide can use to establish and encourage food innovation districts.¹⁶

DENMARK

Denmark, as a country, has a reputation for being collaborative and innovative in numerous areas so it comes as no surprise that they have been recognized for their vision as they seek to build a world-leading food innovation cluster.¹⁷ This vision has developed partly due to the cooperative mindset which is evident in the Danish culture.

The first cooperative store in Denmark was established in 1866, inspired by another cooperative store based in England. This type of arrangement was adopted very quickly throughout the country and in 1896 the stores consolidated into a national organization, which branded many of its goods. By 1919, about 10 percent of all retail sales originated in the approximately 2,000-member stores. Many other countries had followed a similar development path, but the success of cooperatives in Danish agriculture has been noted as being particularly important.

Technology improvements, specifically for butter production, were key drivers for this change as they allowed for high volumes of fluid to be processed in an efficient manner while maintaining high quality. In 1882 the first cooperatively owned dairy was established following the basic principles of: 1) Same payment price/unit, regardless of how much a farmer delivered for processing, 2) All members have one vote, regardless of farm size, and 3) All members shared liability for the cooperative's debts, in proportion to their deliveries. The number of cooperative dairies increased rapidly, and by 1900 almost all dairy production in Denmark was accomplished through cooperatives. At a national level shared companies were formed to focus upon export marketing and technological research which enabled Denmark to be a leader in the dairy industry. The development of more cooperatives continued; first in the meatpacking industry and closely followed by poultry, vegetables, fish and fur. Another wave was seen after WW II when shared laundries and freezers were established. This movement is the root of Denmark's 'welfare' state and the development of a culture that supported strong labor unions and the creation of a society with a large public sector.

In the late 1960's and 70's consolidation began across many industries. This rationalization led to the creation of a few large national and international companies. It is notable that Arla Foods, Danish Crown and DLG Group are still recognized as the pillars of the Danish agricultural sector. It should be noted that over the next few decades the cooperative culture began to change as engagement deteriorated and memberships declined dramatically. These large cooperative companies do not differ much from regular commercial companies, as they have gone through waves of mergers and acquisitions.¹⁸ Also, it is also important to recognize that very few new cooperatives are being formed, and not many companies remain with highly engaged members. Having this historical perspective is important as we consider and evaluate business structures that may be suitable for our food system as we move forward.

PILOT PLANTS

UNIVERSITY OF MAINE

The Dr. Matthew Highlands Food Pilot Plant offers services to enhance product lines, create value-added foods or scale up recipes for commercial production. The Pilot Plant is a research-based facility, which is available for a fee, depending upon the complexity of the project. It is a state licensed commercial kitchen with limited facilities and equipment like: 1) Belt driven convection steam cooker, 2) Commercial smokehouse, 3) Cheese making equipment, 4) Potato processing equipment, 5) 2-bay vacuum sealer and 6) Blast freezer.

The University of Maine Cooperative Extension together with the research cluster of Food Science and Human Nutrition offer the following services: 1) Resources for Small Food Businesses, 2) Product and Process Review, 3) Sensory Evaluation, 4) Grant Writing Support/Review, 5) Analytical Consulting, 6) Assistance in developing new food products, and 7) Applied research for trouble-shooting issues.¹⁹

PENNSYLVANIA STATE UNIVERSITY

State-of-the-art Food Science Pilot Plants are designed for processing flexibility with an emphasis on product specialization. The facilities are used for teaching, research and industry projects; accommodating multiple activities simultaneously. The Pilot Plants are ideal for the evaluation of new ingredients, formulations, and processes on a small scale, and for short course lab and equipment demonstrations. Floor plans are open and most of the equipment is on wheels, with utility stations positioned throughout each plant that allow for flexibility

on short and long-term projects. Utilities included at the site are: city water, medium pressure steam, air, vacuum, RO/DI Water, Natural gas, Electric (110, 220, 440 V, 1 and 3 phase) and Internet.

The Wet Pilot Plant is designed for processing fluid and wet foods, with an emphasis on dairy products, fruits and vegetables. The processing space is 4000 sq. ft., with a dedicated walk-in cooler and freezer with additional dry storage. Loading dock complete with overhead door and lift.

The Dry Pilot Plant is designed for processing products in a low relative humidity environment, with an emphasis on powders and confectionery products. It has 2000 sq. ft. of processing space with a dedicated walk-in cooler, freezer and dry storage. Loading dock complete with overhead door and lift.

The Food Safety Pilot Plant is designed for challenge and validation studies in a controlled environment. It is a CDC Biosafety Level 2 rated facility. The 900 sq. ft. plant features a Decontamination Room, and Media Preparation Room equipped with culture freezer, autoclaves, and dishwasher with pass-through autoclave. All waste streams are directed to a heat digester.

The Sensory Evaluation Center has been conducting sensory evaluation and consumer tests for University researchers and food industries since 1972. Sensory analysis uses human senses to consistently measure food characteristics such as taste, texture, smell, and appearance in a controlled environment. The information collected assists the food industry in addressing consumer demands and introducing new and improved products.²⁰

CORNELL UNIVERSITY

CORNELL VENTURE CENTER

Cornell provides a team of professionals with expertise in all aspects of food safety and regulatory compliance. Teaching, research and extension programs are integrated to support the development and success of agricultural, value-added, food products. Entrepreneurs have access to established Cornell facilities such as: Analytical Laboratories, Fruit and Vegetable Technology Pilot Plant, Vinification and Brewing Technology Laboratory, Food Processing and Development Laboratory, USDA Approved Meats Laboratory, and Dairy Pilot Plant.

ITHACA-The Food Processing and Development Laboratory (FPDL) / Pilot Plant

The 10,000 sq. ft. main processing area is located adjacent to fully licensed operating dairy plant. This combination allows for scaling up of production in order to provide a variety of products for customer demonstrations, food shows, and exhibitions. Experienced full-time staff professionals are able to assist in all aspects of food product development and processing. Entrepreneurs may work collaboratively with personnel, or the staff of the FPDL can process products according to specifications and ship overnight. The pilot plant is also available to external clients on a fee-for-service basis.²¹

GENEVA-NYS Food Venture Center / Fruit and Vegetable Processing Pilot Plant

A 10,000 square foot facility on the Geneva, NY campus devoted to the preservation and processing of fruits and vegetables. It includes an extensive equipment inventory and full utilities. Numerous pieces of equipment ranging from a ceramic ultrafiltration unit to an FPS pouch system are available in the pilot plant. Complete processing lines include continuous applesauce processing, apple/grape/tomato juice processing, and green bean canning.²²

RUTGERS UNIVERSITY

The Rutgers Food Industry Gateway (RFIG)²³ provides access to business and technical expertise for emerging and established food companies and utilizes its outreach capacity to serve food and agribusinesses globally. Resources available through RFIG include assistance in business development, scientific research, market research, product and process development, tech commercialization, extensive training programs, advanced analytical services, food and beverage packaging, regulations and compliance support, and quality assurance and food safety systems.

FOOD INNOVATION CENTER-NORTH

The Food Innovation Center - North is a 31,000 sq. ft. facility operated under constant USDA inspection and is a FDA licensed canning facility. Development, scale up and short production runs are accomplished at the flexible facility. The focus is on production for consumer tests, small test markets and start up related activities. The shared facility is available for short- or long-term leasing and is home to a number of small N.J. food and ingredient companies who develop and manufacture their products in their facility.²⁴

The manufacturing facility contains 7,500 square feet and is USDA/FSIS/FDA approved manufacturing space, as well as a Product Development Laboratory, Quality Control Laboratory, Pilot Plant, Warehouse and other support space including an information resources room, a conference room, and offices. The facility and related equipment are available for short- and long-term use for proprietary product and process development. Technicians and staff are available to instruct, supervise, and assist in conducting test work.

The Product Development Kitchen is available for clients interested in producing preliminary product samples. It contains typical bench-scale and restaurant sized kitchen equipment. It is available on a daily or weekly basis.

The Quality Control Laboratory contains basic instrumentation and laboratory materials necessary for bench-top ingredient, packaging, and product testing during the formative stages of R&D projects and is also available on a short-term basis.

The Pilot Plant equipment includes: a hot air impingement oven, two (2) horizontal form/fill/seal packaging lines for flexible pouches, heat seal packaging line, commercial and development size sterilization retorts with multiple heating modes, homogenizer, meat injection equipment, steam jacket kettles and associated pumps, baking ovens, hot pack line for beverages, walk-in freezers and refrigerators.

COMMERCIAL PARTNERSHIP: Pinnacle Foods (Now Conagra Brands) opens pilot plant at Rutgers University

The pilot plant at Rutgers Food Innovation Center-North, located in Piscataway, is the first university-affiliated pilot site for Pinnacle. It expands the company's existing relationship with the institution that began last year

through an undergraduate internship program. Through the expanded collaboration, Pinnacle will leverage the technologies of the University, partner with the Food Science, Packaging and Engineering departments and have the opportunity to sponsor specific graduate research work to benefit both student learning and the company.

Fitted with equipment, the pilot plant will enable Pinnacle to replicate existing production processes at its Grocery Division plants and conduct consumer testing. Additionally, Pinnacle will be able to evaluate various process changes outside the plant environment and bring in equipment for testing. The plant is a USDA and FDA-inspected facility that will comply with Pinnacle's quality, safety, training and standard operating protocols. [Source: Pinnacle Foods Inc., June 10, 2014]²⁵

FOOD INNOVATION CENTER-SOUTH-INCUBATOR FACILITY

The Rutgers Food Innovation Center South incubator facility houses shared-use food processing space for an array of products and processes, marketing capabilities and technical laboratories. The business incubator enables new companies to be formed, and provides resources and technologies to existing food companies as well. This facility is designed for use by farmers and cooperatives, startup food companies, existing small and mid-sized food companies, and retail and foodservice establishments who are assisted from concept to commercialization, may have new product prototypes tested and evaluated, and have products produced in a state-of-the-art food processing facility that meets the regulatory standards of local, state and federal (FDA and USDA) agencies. Client Services allows for both business and technical mentoring and training services. Clients can be assisted from concept development, to commercialization, to development of a marketing and selling strategy by Food Innovation Center staff.²⁶

The shared-used processing area includes:

- Refrigerated Foods Processing Room
 - Refrigeration controlled facilities for fresh-cut produce, or value-added meat, poultry or seafood products
 - Equipment in the refrigerated processing room
- Beverages and Hot Processing Room
 - Processing equipment for Beverages, Soups, Sauces, Stews, Salsas, Jams and Jelly, Grilled and Roasted Vegetables, and Prepared Entrees
 - Equipment in the wet / hot processing room
- Bakery and Dry Processing Room
 - Processing equipment for Pies, Breads, Cookies, and Confectionery products
 - Equipment in the bakery and dry processing room
- Cold Assembly/Clean Room
 - Packaging of perishable products in HEPA-filtered clean room
 - Equipment in the cold assembly / clean room

REVIEW & RECOMMENDATIONS

The food processing and manufacturing industry in Maine is long lived and complex. Determining and planning the most effective manner in which to guide and influence its future is a topic that brings up a variety of opinions and diverse perspectives. Just how we should move forward on the design of a comprehensive system model, the development of tactics, and implementation of near and long-term strategies will be a challenge for all involved. It is of vital importance that we consider industry experience as we develop Maine's plan to support the growth of small and mid-sized businesses in this network. With careful consideration, we will be able to create an ecosystem that empowers businesses to blossom, and support the development and growth of a resilient and sustainable food system.

In the near-term we may focus upon opportunities to co-locate businesses, which for stand-alone enterprises, may be a way to mimic some of the activities related in the Case Studies, Program Reviews and Pilot Plants sections of this primer. Co-located businesses may be thought of as 'Incubator Facilities' or small scale 'Innovation Districts', like the cohort located on Industrial Way in Portland. Beginning with Allagash and Rising Tide brewing companies, this community of interrelated food businesses has created an environment that supports individuals that benefit from each other's success. Another example is Ocean Approved and their recent facility rental to fish and land vegetable processors. Both of these provide good examples of incremental growth and expansion of local businesses.

After the review of many food clusters, hubs, university pilot plants and innovation districts I am impressed by the vision, commitment and time it has taken to get these organizations to the point where they have reached critical mass. These endeavors are not for the faint of heart or 'short-timers', but rather for those in it for the long-run, supported by a vision of what their value chains and food systems will look like in the future. These organizations have developed networks that have grown strong and become successful. It is of great importance to focus on their common building blocks, since they are fundamental to supporting business operations.

Shown below are some of the key takeaways from this research that I would like you to consider when planning the future of Maine's Food Processing and Manufacturing Landscape.

- **Shared Community Vision** of all food system stakeholders
- **Funding from a variety of resources:** public, private, governmental, grants, real estate developers for innovation districts
- **Education/Training/Technical resources on site:** Food Safety, Business Planning, Product/Recipe Development, Marketing/Sales Training, etc.
- **Infrastructure:** Processing rooms with appropriate equipment and flexibility, Storage Facilities (dry, cold, frozen), Logistics & Transportation capacity. Many have USDA/FDA certified plants which enables product sales beyond state lines. Current state-of-the-art technology.
- **Kitchen/Business Incubators:** Depending on the site and businesses located together these may be considered to be 'co-located' or an 'innovation district'.
- **Shared use processing space**
- **Rental production space**
- **Organization for Marketing and Sales to Institutions**
- **Commercial Business Partnerships**
- **Incremental growth:** Expanded over time, not over built even when funding was available

ENDNOTES

- ¹<https://www.devex.com/news/agricultural-value-chains-a-game-changer-for-small-holders-83981>
- ²<https://www.fsis.usda.gov/wps/portal/footer/policies-and-links/significant-guidance-documents>
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- ¹⁰<https://hardwickagriculture.org/about/case-studies/vfvc-farm-institution-minimal-processing>
- ¹¹<https://www.foodprocessing-technology.com/projects/mad-river-food-hub/>
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- ¹³<https://businesswest.com/blog/food-processing-center-gives-clients-the-right-ingredients>
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- ¹⁷<https://www.hks.harvard.edu/centers/mrcbg/publications/awp/awp50>
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- ²¹<https://foodscience.cals.cornell.edu/about-us/facilities/ithaca-facilities/>
- ²²<https://foodscience.cals.cornell.edu/about-us/facilities/geneva-facilities/fruit-and-vegetable-processing-pilot-plant/>
- ²³<http://foodgateway.rutgers.edu/>
- ²⁴<http://foodgateway.rutgers.edu/fic-north.html>
- ²⁵<https://businessportal.rutgers.edu/node/42>
- ²⁶<http://foodinnovation.rutgers.edu/F-South.html>

ADDENDUMS

ADDENDUM A: FULL TERMINOLOGY/PROCESS DOCUMENT

ADDENDUM B: FULL SEASONALITY CHARTS