# UBC Food Processing Facility

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# Scenario 7: UBC Food Processing Facility

## LFS 450: Group 10

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**Abstract**
This paper's objective is to design a food processing facility as well as assess the feasibility of a UBC Farm food processing facility. We conducted a literature review to find example on-campus food processing initiatives and food safety certification requirements, developed a needs assessment through interviews with our stakeholders, and designed a sample building plan. From our findings, we recommended start-up operations focusing on three processes: cheese making, juicing, and freezing. Based on a triple bottom-line analysis, an analysis of a project's economic, environmental, and social components, we concluded that it would be feasible to begin with the recommended three food processes. Key rationale for our decisions is the availability of local supply. A source for cheese and juice ingredients are abundant in the lower mainland and reduces the emissions and cost of transport is smaller relative to other food processes. To conclude, we recommend a study to determine the interest of other faculties in having a stake a UBC Farm processing facility. Educational opportunities for providing such a facility are vast and open collaboration with other faculties can only help this facility.

## UBC Farm Pilot Food Processing Center

The UBC Food System Project has determined that the lack of locally grown and processed food is a major barrier to local food security and food system sustainability. As such, the Center for Sustainable Food Systems - UBC Farm has identified a pilot food processing center as an important component of the future Farm Center. In preparation for the pilot food processing center, the Campus Sustainability Office's UBC Climate Action Plan and LFS Community members have expressed interest in better understanding the potential benefits and challenges of on-campus food production. Many questions have been raised surrounding the actual environmental impact, economic feasibility, costs and potential benefits, as well as the social costs of this proposed facility.

## Methodology

To answer these questions, our main objective is to assess the feasibility of a pilot food processing facility at the future UBC Farm Center. In order to do this, we have developed an outline:

- <u>To conduct a literature review of other universities that have food processing facilities on site. Assess the strengths and weakness of each university's facilities and how we can implement this into our system.</u>

This is to gain a better understanding of what is required in a food processing facility and to see how other universities in similar situations to ours have gone about tackling the needs of such an undertaking.

- To perform a needs assessment through discussions with project stakeholders. This is to ensure that the people who have the greatest stake in the facility will have a say in what will be produced. Also, this gives us an opportunity to garner some of their expert opinions on what we can produce based on what we have available and what we, as a university, want to produce.
- To conduct a literature review of the different types of food processing methods and equipment necessary for a pilot project. We decided to learn more about the different types of food processing methods so that we could gain a better understanding of what we could do at the farm in terms of value added products, as well as the types of machinery required for the processes that we decide to incorporate.
- To design a pilot food processing facility based on discussions with stakeholders and compiled literature reviews. Then, to use triple bottom line analysis to explore the economic, social and environmental impacts of the designed food processing facility. This is where we tie everything we have learned together into the final concept for the processing facility. We use the triple bottom line analysis to determine whether or not this facility is feasible based on its social, economic and environmental sustainability.

## Problem Statement

We have been tasked with assessing the feasibility of a pilot food processing facility at the future UBC Farm Center. Our main goal is to design and determine the requirements for a viable pilot food processing facility while taking into account the needs of the UBC campus community.

The current productivity level of the UBC Farm provides various produce for consumers both on and off-campus. Most of the produce are perishable and sold during the summer months at the UBC Farm Market. In order to prolong the availability of produce supply for consumers as well as increase the varieties, a food processing facility would be required. The facility could also provide service for farmers in the lower mainland who are interested in processing their produce for a fee.

# Findings

## Literature Review on Different Campus Initiatives

Similar on-campus food processing initiatives were researched to provide us with a frame of reference to begin our assessment. Existing processing facilities at Cornell University, Michigan State University and the University of Minnesota were studied because of their different production processes and objectives of their extension facilities.

### Cornell University - Wine & Beer

- Types of production: Wine and Beer production
- Facility Characteristics
  - Pilot plant facility
  - Lab utilities are made to allow for the ease of movement of processing equipment.
- Objectives of Facility
  - Student research projects on industrial-scale equipment
  - To provide a space for equipment manufacturers and distributors to demonstrate new equipment. Rental fees are paid for any tests/small production done at the lab.

### Michigan State University- Fruits & Vegetables

- Types of production: Fruits and Vegetables processing
- Facility Characteristics

- Facility is approximately 4000 sq. Feet
    - Small-scale equipment
  - Facility is flexible and deals with quality, storage, processing, marketing, distribution, safety and consumption of food crops.

- Objectives of Facility
  - Researchers conduct basic and applied research in various areas of processed food
  - Collaborate with various groups including growers, processors and relevant government agencies through research projects completed in the facility.
  - Provide space for equipment manufacturers and distributors to demonstrate new equipment. Rental fees are paid for any tests/small production done at the lab.

**University of Minnesota- Dairy**

- Type of production: Dairy processing

- Facility Characteristics
  - Certified and inspected by the State of Minnesota as a food production facility.

- Objectives of Facility
  - Products processed and developed are used for market research as well as a source of revenue for the university.
  - Consultation and assistance in development of novel processes and products
  - Evaluation and analysis of samples or prototype products.

## Needs Assessment

After consulting with potential stakeholders and members of the UBC community and conducting a needs assessment, we were able to compile a list of types of products this facility would provide and the possible benefits of such a facility.

One of our stakeholders, Jay Baker-French, believed that an on-campus processing facility would be beneficial in its modelling of a real food system for students and the community. It would also increase demand for local food processing. However, the UBC Farm and Orchard Garden would not be able to supply all the raw produce that the processing center will need. This is due to the fact that the primary focus of the farm and the garden is on student engagement while production is considered secondary. Agora receives many of its products from the UBC farm and volunteers are in charge of processing, namely freezing and packaging. According to the manager, Alvin Tejuco, if Agora is one of the stakeholders, a processing facility would allow it to receive a bigger variety and volume of produce from the farm and orchard garden. Several of our stakeholders suggested that the facility not be limited to just a food processing plant, but also be used for educational purposes. The processing facility can host students from different faculties to take part in workshops and learning activities that will add to their learning experience. For example, the FNH 200 curriculum involves a thorough discussion on processing techniques such as canning and freezing. A visit to the processing facility to see these techniques and equipment first-hand would show students how these methods are used in real-life settings. The food produced by the processing facility could potentially be sold to AMS food outlets and also at the Saturday Farmers' Markets to make profit. The processing facility can be divided into separate sections which can include an area used for machinery, one to be used as a community kitchen and learning station and one for storage of food products.

Another stakeholder recommended food processing that is in harmony with UBC's goal for sustainability. He suggested we focus our efforts on canning and freezing to preserve fruit and vegetables. During the harvesting season, a company called “Discovery Organic Produce” provides a large amount of affordable produce from which the processing facility can benefit. Equipment on wheels was highly suggested for ease of mobility and cleaning. We were steered away from the idea of having a brewery due to the requirement of a liquor licence and the fact that the new sub has plans for a small-scale brewery.

We looked into the supply needs of AMS food outlets including Bernoulli’s Bagels, Bluechip, Agora, the Pendulum and Pie $R^2$ to get an idea of the types of processed foods they would need from the pilot food processing facility. We arrived at the conclusion that cheese, juice, dried and frozen fruit as well as soy milk and tofu are in highest demand.

Based on our needs assessment, we recommend the following food processes: cheese making, juicing and freezing. We will further evaluate these three processes based on the triple bottom line assessment later on in the report.

## Equipment & Machinery

The processing facility will start with cheese, juice processing and freezing. As shown in Appendix E, these three products are of highest demand by almost all the UBC food outlets at the moment. As the budget, scale and expertise level grow, different processing equipment can be added, allowing for more processed foods to be made. Eventually, the processing facility should be equipped to make wine, canned foods, tofu, and soy milk, and be capable of different types of tomato processing methods (i.e. crushed tomatoes and tomato paste).

### Cheese

A large tub-like vat is needed for curd making which involves the addition of rennet or acid to milk to cause coagulation. The vats of curdled milk are cut horizontally and vertically using sharp, multi-bladed, wire knives that look like oven racks. As the curds and whey separate, the whey is drained. The leftover curds are pressed into a block, cut into pieces and placed into a cheese mould. Following the cutting and separating process, curds are heated to further the separation. The Tetra Tebel Casomatic SC 7, pictured in Appendix D, is fully automatic and is able to drain whey, press curds, form cheese blocks and fill moulds, all in a sequence.

Moisture must then be removed from the curds by pressing and applying pressure. Rate of pressing and amount of pressure depends on the type of cheese that is being made. Cheese is then salted and the salted curds are fused together under a vacuum to form cheese blocks.

### Juice

A Belt Press Filter is needed for the dewatering process of juice production. For smaller scale juice production, a Juice Screw Extractor can be used. This machine is smaller than the Belt Press Filter and therefore produces less juice. The Juice Screw Extractor can produce about 0.5-1.5 tonnes of juice an hour while the Belt Press Filter produces 2.5-10 tonnes an hour depending on the size of the machine. See Appendix D for pictures of both machines.

A Bottle Overturn Sterilizer is needed to sterilize juice bottles and transfer them to a cooling tunnel. A bottling machine will also be needed to package the juice into recyclable glass bottles which can be returned to the processing facility once used. A Vacuum Degasser is necessary in fruit juice production to ensure juice is purified and to prevent the juice from being oxidized, thereby extending its shelf-life.

## Freezing

A blast freezer would be the best choice to serve the purpose of freezing fruits and vegetables. These freezers are intended to bring the temperature of foods down at a very fast rate, thereby maintaining their quality and texture. Once the food has been frozen in a blast freezer, it can be moved to a walk-in freezer for storage and still maintain its quality.

The intense cold that the food is exposed to inhibits microbial growth and therefore, if the food is immediately transferred to a freezer, storage life is extended and contamination is avoided.

## Food Safety: Certification and Inspection

Recent food safety incidences such as the listeria outbreak have led to consumer demand for food safety assurances from processors. The Hazard Analysis & Critical Control Points (HACCP) system is one method of improving the food safety of processed products. HACCP has become a universally recognized and accepted method for food safety and inspection.

The World Health Organization (WHO) has recognized the importance of HACCP systems for prevention of foodborne diseases for over 30 years and has played an important role in its development and promotion. Codes Guidelines for the Application of HACCP system have been adopted by the FAO/WHO Codex Alimentarius Commission. All relevant Codes of Hygienic Practice include HACCP Principles, including the Codex Code on General Principles of Food Hygiene. The Codes Guidelines play a crucial role in the international harmonization of the application of the Codex system. Codex standards, guidelines (including the Guidelines for the Application of HACCP system) and recommendations constitute the reference for food safety requirements in international trade.

Although HACCP systems are not yet required, many food processors are beginning to implement these systems into their production processes. HACCP certification acts as an assurance scheme for consumers. There are two ways to be food safety certified: using international food safety standards set by the International Standards Organization i.e. ISO 22000 or Global Food Safety Initiative (GFSI) or using domestically acknowledged assurance schemes such as the BC HACCP system. For our food processing center's objectives, international assurance schemes are considered unnecessary because of our focus on providing products to the local community. Our most likely option is to get certified by BC HACCP. Implementing a HACCP system will qualify us for funding provided by the Government's Food Safety Initiative (FSI) program. Appendix B includes a link to the BC Food Safety Initiative website and a list of contacts to discuss HACCP procedures and certification of the food processing facility.

# Discussion

## Triple Bottom Line Analysis

### Environmental

One of the main goals of the UBCFSP is to identify barriers that arise in the transition towards a sustainable food system and to address them through project implementation. One of the barriers that may arise with a pilot food processing facility is the unfavourable impact it may have on the environment. In order for our processing facility to be feasible it has to have a very low impact on the environment. Otherwise, it will not be able to continue its production without negatively affecting the quality of the inputs from the farm used in the production process. Another main goal of the university is to be sustainable, and negatively affecting the surrounding environment is anything but sustainable. Therefore, we need to minimize any negative effects of the processing facility and if possible, increase the positive effects.

One of the areas of concern when dealing with this facility is the increased energy consumption that is unavoidable when dealing with processing. Even without equipment, the facility will be drawing more energy simply by keeping the lights on and heating the facility for the comfort of the workers. With the equipment, we need to consider the increased energy consumption caused by the machinery for freezing, juicing, and especially refrigeration of products prior to distribution. There are several methods to off-set the environmental cost, such as solar panels to collect energy to reduce the draw of power from the grid, or an underground refrigeration unit since it is naturally cooler and will thus require less energy to lower the temperature.

With the processing of vegetables and fruits there is the possibility of excess waste from peeling and cutting etc. With the farm being in close proximity to the processing facility, organic waste from the facility can be used as compost material to benefit the growth of future plants. The excess waste from any packaging that is done at the facility however is unlikely to be useful in any composting initiatives unless we use biodegradable options.

Cleaning the fruits and vegetables has the potential to increase the water usage of the facility. However, if we collect the water after it is used to clean the vegetables and fruit we can then use it to feed other plants on the farm along with any nutrients and biomass that comes off the plants through the process of cleaning.

The transportation of the goods may increase the transportation costs of the farm and farm-related outlets. The reduced transport costs of people buying local food will hopefully offset the overall transport emission costs.

**Economic**

As part of the triple bottom line analysis, the existence of the future processing center depends on its ability to satisfy economic requirements. In order for the processing center to be self-sufficient it must at least break even. The cost of operating the processing center includes purchase of raw food supplies not available at the farm, transportation, equipment, maintenance of the facility, sanitation, employee salaries, and personnel training. The processing center will add value to products obtained from the UBC farm.

**Demand and Supply**

Based on our findings on availability of supply and consumer demand, the food processes we chose would be the ideal for the processing facility's start up production.

*Cheese*

Milk supply is readily available through our Agassiz dairy research centre as well as through outsourcing from local dairy production facilities (i.e. Kitzel Farm). Referring to appendix E, a large number of AMS food service outlets require cheese as an ingredient for their food products.

*Juicing*

Juicing can be done for a wide variety of produce harvested from the UBC farm. Local outsourcing can be done for products such as blueberries, cranberries and other seasonal products. Although demand has not been realized yet for juicing production, students may be interested in buying fresh local juices, provided their quality is comparable to juice products that are currently offered.

*Freezing/Preserving*

Freezing is considered a complement to the above products. It is necessary to maintain supply of produce past their seasons. Preservation is one way to improve the cost structure of the facility as well as improve stability of supply of ingredients and processed goods. We are able to process goods at volumes greater than demand for the purpose of economies of scale. Storing these processed products such as blueberry juice would mean we can continue to meet consumer demand even after the blueberry harvest season.

**Labour Productivity**

Although Mason *et al.*'s study focused on comparisons of productivities across several European processing facilities, the findings are relevant in evaluating the economic aspects of an on-campus processing center (1994). If one is to produce high value goods, staff and training are essential. We must provide sufficient training for workers and employ staff with expertise in various disciplines in order to increase productivity and profit. Since we are in a university setting, we have the advantage of recruiting staff and students who might provide valuable knowledge to the UBC processing plant project. However, due to the fact that this is a pilot project, technical advice should be taken from professionals in the food processing industry.

**Marketing Mix**

We assessed the economic conditions under the four P's: price, product, place and promotion. **Price** of the value-added products will be based on processing cost plus premium. Premium will be based on a break-even analysis of farm production. Other revenue generating activities will be discussed later on. Based on the needs analysis, the **product**s we decided to incorporate in the facility are cheese, juice and frozen foods. **Place:** Since our market, which is the UBC community, is within close proximity of our processing facility, an on-campus processing facility will decrease logistical and transportation costs for locally sourced products. Demand for the aforementioned products is based on our needs assessment and analysis of UBC food services and product usage charts. The sales would be **promoted** under the UBC Farm brand which would further increase premium and raise awareness among UBC students.

**Social**

With the new facility, the farm will require more labour, which could serve as an opportunity to increase student involvement at the farm and to encourage more community interest. The UBC processing facility could also be used by local farms that are in need of processing for their products. We could either make them partners so that the facility has a larger pool of land to use for inputs or rent out the facility to those local farms to help increase the profits of the farm.

The processing facility could also be used to educate local elementary and high school students on where their food comes from and what happens to their food from the farm and to their plate. Educating future generations is one of the basic principles of what a university is supposed to do.

Since the facility is a university initiative, it would make sense that research be conducted at the new farm center on new processes and the benefits that come with some of the products produced at the facility. Research into future products that the facility may be interested in making such as wine would also be a viable undertaking.

This project is going to be a part of the University of British Columbia, one of the top universities in Canada, and for this reason, the social aspects of it, including research and student involvement should be highlighted as the main alternative uses of the facility. We should have no problems in finding ways to make this facility socially sustainable.

## Recommendations

### Incorporation into Academics

Many professors and staff would be interested in being involved in such a facility. For example, Dr.Christine H. Scaman is an associate professor in Food Nutrition & Health (FNH) at UBC who believes that having an on-campus food processing facility is very promising. She is currently working on projects including Investigation of alpha-Glucosidase I (GluI I), Tyrosine/Phenylalanine Ammonia Lyase (T/PAL) and Tinamou Egg Proteins. She teaches Food Science courses to both undergraduate as well as graduate students. Dr. Scaman believes that such a facility will be important for educating students, making UBC farm produce available for campus consumption, and making these types of processing equipment available to the entire community. She suggested the facility be incorporated in the curriculum of some graduate courses such as FNH 425. This course is comprised of a group of four to five students who study food production issues. These students are usually sponsored by companies that have facilities they can use. The facility could also compliment several undergraduate courses. She suggested the following processing methods: canning, fermentation, dehydration, wine making and juicing.

The facility can also be used across different faculties. For instance, engineering students can design and build equipment according to the needs of the facility. Commerce students can use the facility to design business plans and deal with budgeting issues. LFS students can work on waste management for the facility. Dietetics and food science students can use the facility to experiment with new food products, manipulating nutritional content to test shelf-life among other things.

## Alternative Uses of the Facility

### Workshops & Labs

Members of the local community could take part in workshops and labs designed by students. These workshops would teach people about the UBC farm and how to make different processed foods such cheese, tofu, and frozen fruits and vegetables.

### Community Kitchen Feasibility

We evaluated the possibility of including a community kitchen as part of our processing center at UBC. Since the UBC farm is working closely with the Aboriginal community, one of our goals is to determine how a community kitchen on campus would benefit this population.

The general health of the Aboriginal population is poor due to low social, economic, and political status (Mundel and Chapmen, 2010). They have a higher risk of developing chronic respiratory disease, diabetes, obesity, and cardiovascular disease than the rest of Canadian population (Mundel and Chapmen, 2010). Sometimes, vegetables, fruits and herbs grown at the UBC farm are used to prepare meals to serve to underprivileged populations (Mundel and Chapmen, 2010). Through the Garden-Community Kitchen project, participants would be given the opportunity to cook their own meals and also build supportive social networks with UBC students, staff and people like themselves. Their ability to prepare and grow their own food would also improve through this type of interactive education. UBC students who participated in the project were often invited to join in the community dinners, allowing them to enjoy the outcomes, meet people and see firsthand, how their work benefits their local communities (Mundel and Chapmen, 2010).

**Food Safety Workshop**

The processing center at UBC farm can also by utilize for students to learn more about food safety. According to a study conducted by Abbot *et al.* young adults are at a greater risk for food-borne disease due to improper cooking skills; therefore it is important to develop food safety practices through education. In that study more than 100 young adults recruited by an American university participated in a study of food safety practices. Participants prepared a meal under observation in a controlled laboratory setting and then completed an online survey assessing food safety knowledge, behaviour and other psychosocial characteristics. The university students reported positive food safety beliefs and high food safety self-efficacy. However, less than half of participants engaged in safe food handling practices (Abbott et al., 2009). This shows that there is a need to increase awareness of food-borne diseases and knowledge of proper cross-contamination prevention procedures. A food safety workshop at the processing facility would accomplish this. Volunteers at the food processing plant can receive food safety training, enabling them to perform safe kitchen practices. This knowledge not only ensure that the safe production at the plant, but will also benefit the students on a personal basis.

### Building Plans

Refer to Appendix A for a sample building outline. We propose setting the processing facility to 10,000 sq feet. This is done to provide the necessary space for the various types of production activities that will be done simultaneously. Furthermore, educational workshops and product development would require different spaces so that they will not interfere with production and to comply with federal regulations. The building outline provided has optional administrative spaces which we will not include.

## Conclusion

After careful consideration of the requirements and consequences of introducing an on-campus processing facility, we have concluded that this project is feasible. The most viable option for a pilot on-campus food production project is one that starts off small in scale and focuses on two to three processing techniques with the help of students and staff and could eventually grow into a large-scale multipurpose facility. We decided to start with cheese, juice and frozen food production since these three processes were in line with the needs of UBC food outlets, potential stakeholders and local community members. The facility would ideally be used as an educational tool in many courses offered at UBC, a place to host workshops and food safety courses that can be designed by students and offered to the public, a community kitchen and also as a means of gaining profit through the sale of processed foods. Through the use of a triple bottom line analysis, we were able to assess the environmental, social and economic impact this facility would have and minimize the negative effects associated with it in order to make it sustainable in all respects. Vancouver is in need of a refreshing turn in local food production and we believe that UBC, with its goal of achieving a sustainable campus food system, is the best place to implement this project.

## Appendices:

**Appendix A:** Building Outline

**Appendix B**: Food Safety Contacts

| Organizations | Contact | Telephone | Email |
|---|---|---|---|
| Vancouver Coastal Health | Virginia Jorgensen | 604-675-6912 | fsi@vch.ca |
| BC Centre for disease control | Sion Shyng (abattoirs & dairy plants only) | 604-660-0260 | Sion.Shyng@bccdc.ca |
| Small Scale Food processor | Manager (Food safety initiative funding) | 1-866-473-7372 | fsi@ssfpa.net |
| Vancouver Coastal Health | Jasmina Egeler (Regional Food Safety Coordinator) | 604-675-3810 | Jasmina.Egeler@vch.ca |

Links:

Food Safety Initiative: BC HACCP Brochure

http://www.bccdc.ca/foodhealth/foodguidelines/FoodSafetyInitiative.htm

## Appendix C

Processing methods (Cheese, juice, tofu, drying, canning, wine, freezing)

| Processing Technique | Machine | Price |
|---|---|---|
| **Cheese** | Large Vat | $3500 – $13 000 |
| | Wire Knives | $25 - $50 |
| | Tetra Tebel Casomatic SC 7 | N/A |
| **Juice** | Belt Press Filter | $20 000 - $60 000 |
| | Juice Screw Extractor | $1200 - $1500 USD |
| | Bottle Overturn Sterilizer | $10 000 USD |
| | Vacuum Degasser | N/A |
| **Freezing** | Blast freezer | $10 000 - $12 000 USD |
| | Walk-in freezer | $5000 - $9000 |

## Appendix D

Tetra Tebel Casomatic SC

Belt Press Filter

Juice Screw Extractor

Bottle Overturn Sterilizer

Vacuum Degasser

Blast Freezer

# Appendix E

**Compiled product needs of AMS food services**

| Food Outlet | Product Needs |
|---|---|
| *Bernoulli's Bagels* | Cranberry and Orange juice, Tea, dried apricots, blueberries, cranberries, olive oil, peanut butter, poppy seeds, pumpkin seeds, raisins, apple sauce, pumpkin puree, tomato sauce, grape jelly, strawberry jam, sundried tomatoes, onion flakes, cheddar, mozzarella, parmesan and cream cheese, butter, soy milk |
| *Pit Pub* | Beer, cheese |
| *Bluechip* | Juice, dried apricots and cranberries, raisins, vinegar, butter, cream cheese, soy milk |
| *Honor Roll* | Juice |
| *Moon* | Juice, ketchup, vinegar, dried garlic, garlic powder |
| *Agora* | Frozen blueberries, carrots, corn, spinach |
| *Pendulum* | Wine, beer, juice, tea, dried apricots, blueberries and cranberries, lemon juice, apple sauce, tomato paste, cheddar cheese sauce, crushed tomatoes, tomato sauce, roasted red peppers, ketchup, peanut butter, strawberry jam, butter, cheddar, gouda, mozzarella and cream cheese, soy milk |
| *Pie $R^2$* | Juice, lemon juice, canned artichoke hearts, olives, pineapple slices, and pizza sauce, cheddar, parmesan, feta, gouda and mozzarella cheese, yogurt |

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