CAPSTONE/DESIGN EXPERIENCE 2016

Boiler Bites: Ice Cream Waffle Balls

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Introduction:

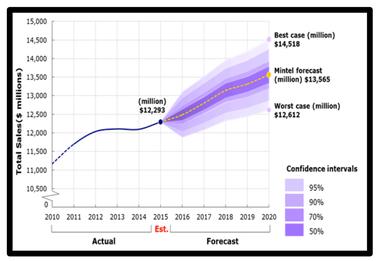
The overreaching goal of this project is to create a company that will mass produce waffle coated ice cream balls to be sold on Purdue University's campus. Economic feasibility, impact on the environment, and a processing plant design are all considered.

Objectives:

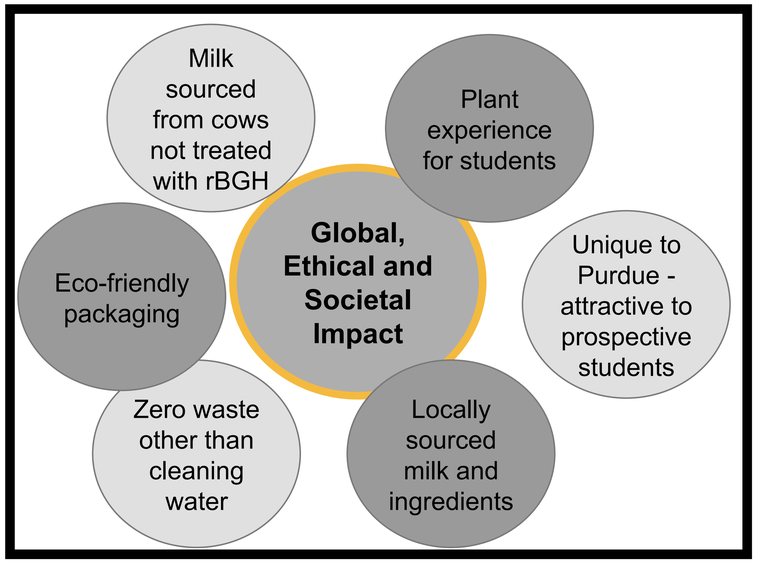
- Create a process with minimal environmental impact (emissions, waste water, waste byproducts)
- Earn enough profit on the product to create jobs for students
- Design processing operations that yield the highest return on investment

Market Feasibility

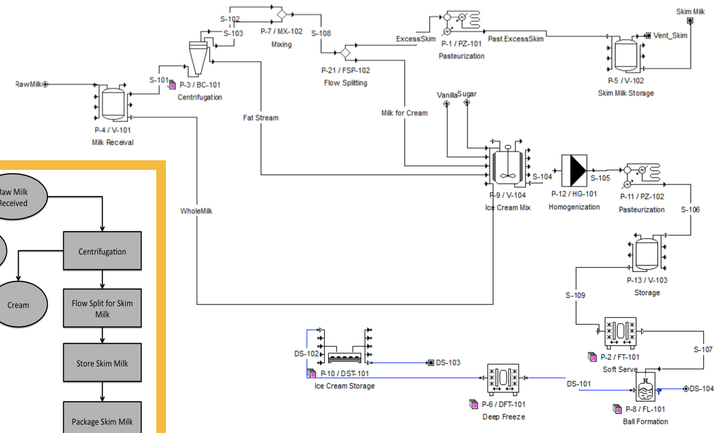
- 90% of consumers have purchased a frozen confection in the last 6 months
- 37% of consumers purchasing frozen treats are millenials
- Consumers are more likely to purchase a dairy-free product

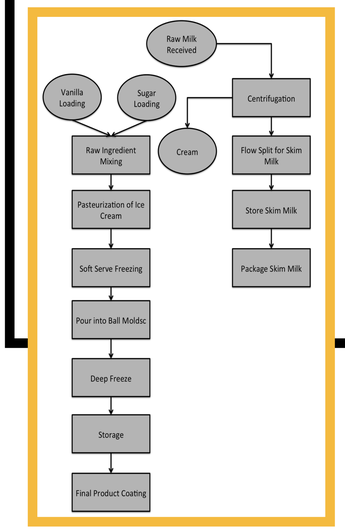


Sales projections, shown in the graph from Mintel, for the ice cream industry, are expected to increase over the next 5 years.



Plant Layout of Ice Cream Process:





Possible Future Improvements:

- Full waffle exterior instead of waffle pieces
- Gluten and dairy-free recipe
- Alcoholic flavored ball with pretzel exterior

Lab Experiment:

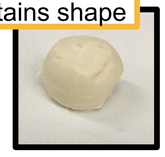
Variables:

- Concentration of sugar in ice cream base
- Time in deep freezer at -20C

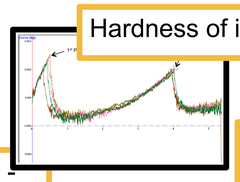
Outputs:

- Hardness/stability of ball

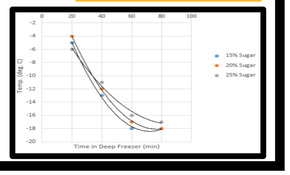
20 minutes - not stable enough



80 minutes - maintains shape



Hardness of ice cream

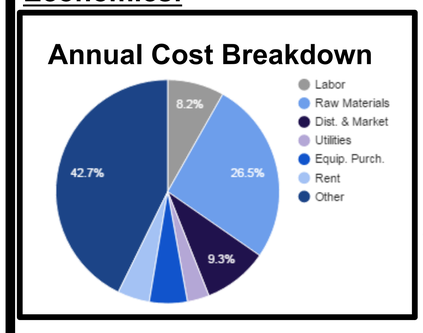


Temperature vs. Time plot

Optimization:

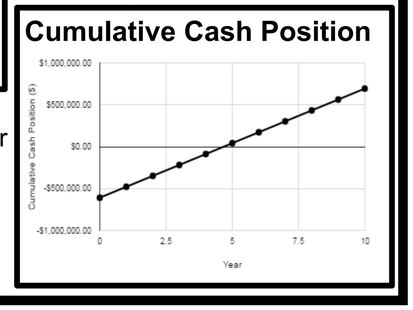
Equipment & Purpose	Size	Cost-Annualized (over 10 years @ 5%)
Centrifuge	Radius: 0.252 m Rotation Speed: 7000 rpm	$4868/year
Pasteurizer - 3 unit plate heat exchanger	Area: 3ft by 5ft Heater: 2 plates Regenerator:110 plates Cooler: 30 plates	$12,355/year
Scrape Surface Heat Exchanger	Surface Area: 0.85 sq. m Rotation Speed: 2000 rpm	$27,250/year
Hardening Freezer	Freezer temperature: -20 Celsius	$751.10/year

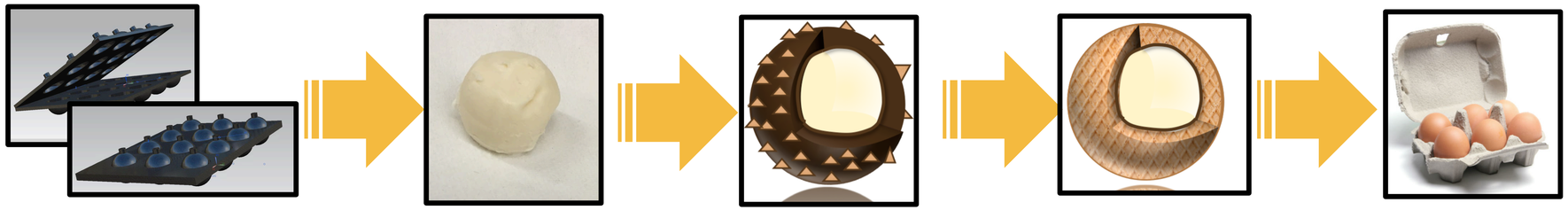
Economics:



- Product price: $4.50/carton
- 6 balls / carton
- Re-selling skim milk to Purdue dining courts
- Distribution occuring at one of Purdue remote dining experiences
- 12.9% ROI

- 3 people working at all times for total of 8 hrs per day
- 3 days/batch production/ cleaning
- 45 batchs/year





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