Introduction:
The overarching 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 millennials
- 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.

Lab Experiment:
- Variables:
  - Concentration of sugar in ice cream base
  - Time in deep freezer -20C
- Outputs:
  - Hardness/stability of ball
  - Full waffle exterior instead of waffle pieces
  - Gluten and dairy-free recipe
  - Alcoholic flavored ball with pretzel exterior

Hardness of ice cream
- 20 minutes - not stable enough
- 80 minutes - maintains shape

Temperature vs. Time plot

Cumulative Cash Position

Optimization:

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

Economics:

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

We’d like to thank Dr. Martin Okos for all his help and support throughout this year-long project!