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INTRODUCTION

Partner: Gedeon Eugene, President, Université Anténor Firmin (UNAF)

Location: Cap-Haïtien, Haiti

Motivation:

- Almost 50% of food is imported¹
- 40% of households in chronic food insecurity²
- Up to 35% of basic food crop is lost in post-harvest chain³



Food Processing in Haiti:

"This is where value is added and where the most profit can be realized, yet there is almost no food processing industry in Haiti..."⁴

GOAL AND OBJECTIVES

To design a commercial food laboratory for students at UNAF where they can learn the skills and technology needed to produce quality, shelf-stable food products that can be transferred into a sustainable microbusiness

- Preserve raw ingredients for the off-season
- Enable small-scale production for local community
- Provide hands-on learning for UNAF students
- Be a business opportunity for the students and community

CONSTRAINTS

- Water quality
- Inputs/resources
- Technical experience of users
- Energy use
- Implementation cost

GLOBAL AND SOCIETAL IMPACT

- Capacity building
- Supply chain development
- Encourage entrepreneurship
- Creation of jobs
- Partnership development

FOOD SAFETY CONSIDERATIONS

Mango:

- Most common fruit grown in Haiti, but spoils very rapidly
- Sweet, fibrous stone fruit
- Approximately 30% waste (peel, stone, and fibrous flesh)



Product Selection:

- Mango Jam
- Mango Nectar

Mango Products:

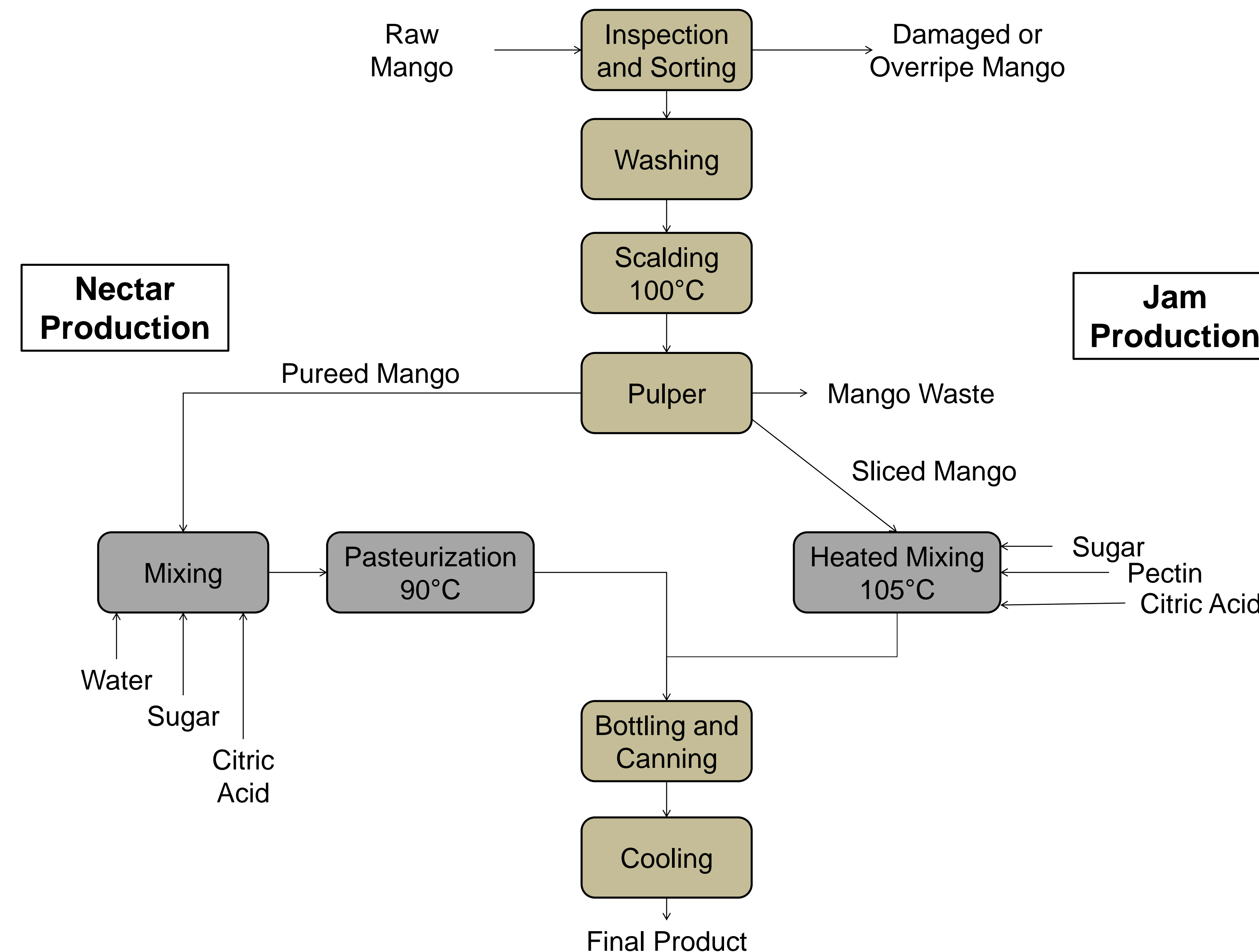
- High-acid
- Low water activity
- Risk of spoilage and disease
- Target microorganism: *Escherichia coli*

Bacteria	<i>Leuconostoc mesenteroides</i> ⁵
	<i>Alicyclobacillus acidocaldarius</i> ⁶
Fungi	<i>Zygosaccharomyces bailii</i> ⁶
	<i>Pichia membranaefaciens</i> ⁵
	<i>Penicillium expansum</i> ⁷
Foodborne Pathogens	<i>E. coli</i> O157:H7 ^{5,8}
	Various <i>Salmonella</i> species ⁸
	<i>Listeria monocytogenes</i> ^{5,8}

PRODUCT RECIPE

Ingredient	Functionality	Mass Percent (%)	
		Mango Jam	Mango Nectar
Raw Mango	Flavor, Color, Body	49.5	30.0
Sugar	Sweetener	49.5	8.7
Citric Acid	Lowers pH	0.6	0.5
Pectin	Gelling Agent	0.5	-
Water	Reduce Viscosity	-	60.8

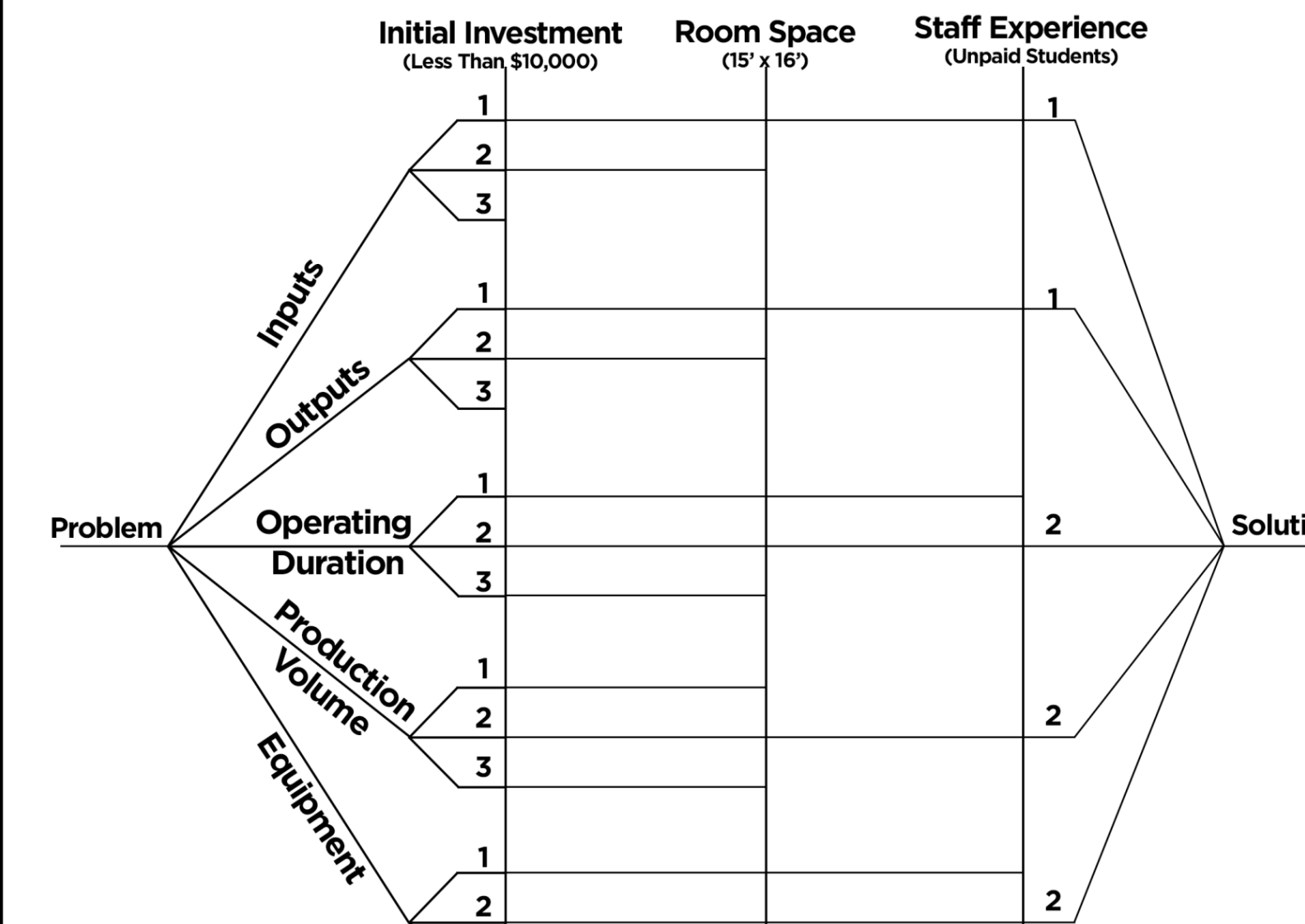
PROCESS FLOW



PROCESSING REQUIREMENTS

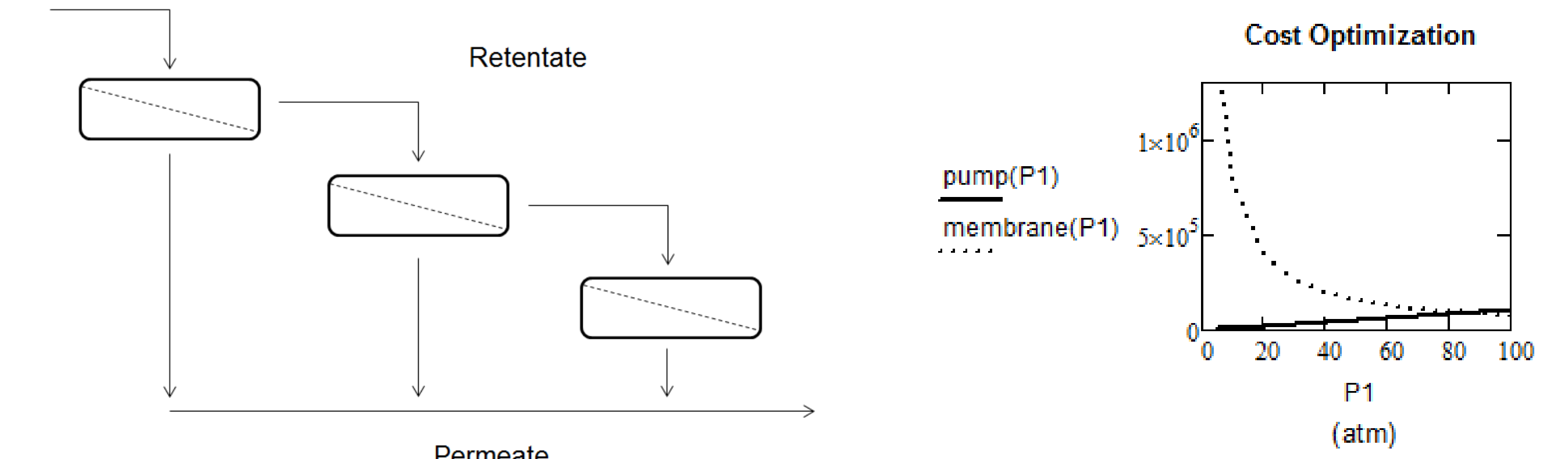
	Juice	Jam	Units
Batch Size	150	200	L
Cycle Time	125	140	min
Mango Input	170	90	kg
Mango Waste	51	27	kg
Water Req. for Product	128	-	L
Water Req. for Processing	737	712	L
Thermal Load	153.1	137.5	MJ

ALTERNATIVE SOLUTIONS



SUSTAINABILITY: REVERSE OSMOSIS

Optimization Goal: To minimize the cost of producing sterile water by changing the pressure required by the pump to produce $6.0 \times 10^{-5} \text{ m}^3/\text{s}$.



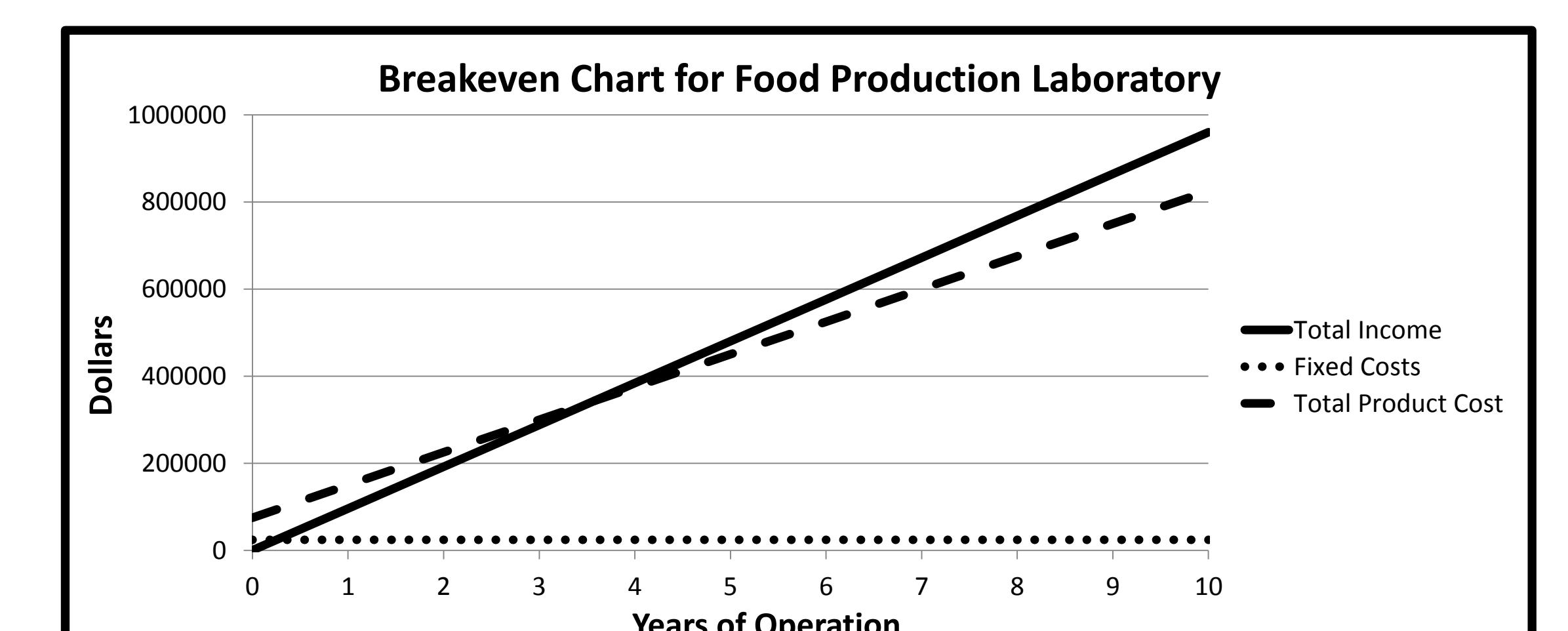
ECONOMICS

Equipment	Size (unit)	Estimate (\$)
Wash Basin	0.51 (m³)	250.00
Scalding Tank (Tank)	1.17 (m³)	250.00
Scalding Tank (Heating)	800 (W)	200.00
Fruit Pulper	350 (kg/hr)	3,000.00
Heating and Mixing Tank	1.17 (m³)	1,500.00
Heat Exchanger	0.125 (m² surf. area)	700.00
Water Bath	0.15 (m³)	350.00
Total Equipment Cost:		\$6,250.00

Total Product Cost	Estimate (\$/yr)
Manufacturing Cost	72,000.00
Direct Production Costs	48,000.00
Fixed Charges	18,000.00
Plant Overhead Costs	6,000.00
General Expenses	3,000.00
Total Yearly Cost:	\$72,000.00

Capital Investment	Estimate (\$)
Direct Plant Cost	12,875.00
Indirect Plant Cost	7,875.00
Fixed-Capital Investment	20,750.00
Working Capital	3,500.00
Total Capital Investment:	\$24,250.00

Product	Unit	Production Rate	Price	Income (\$/yr)
Mango Jam	500 mL Jar	7,200 jars/year	\$10.00	\$72,000.00
Mango Nectar	1 L bottle	4,800 bottles/year	\$5.00	\$24,000.00
Total Yearly Income:				\$96,000.00



FUTURE WORK

- Design course curriculum to introduce students to food processing
- Find and train project manager
- Address sustainability hurdles
- Identify local market opportunities

IMPLEMENTATION

The partner is invested in this project (will be constructing a new building on the university property) and is eager to implement as a microbusiness for UNA.

References

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