

Gregory Bandy (BE), Davis Jeffries (BE), Henry Ludwig (BE), and Olivia Murch (BE)

Problem Statement & Background

Goals:

- To create a grape wine and an alternative fruit wine that meet the growing demand for locally manufactured products
- To develop a profitable business
- To design a zero discharge minimum energy plant

Objectives:

- Provide unique locally made and sourced wine products for local consumers
- Provide supply of craft wine products for open and expanding market
- Provide innovative fruit alternative wines

Market Analysis

- Target demographic is millennials, who are largest group of consumers in U.S.
- Data shows a 3% increase in wine sales revenue between 2016 – 2017

Impact & Sustainability

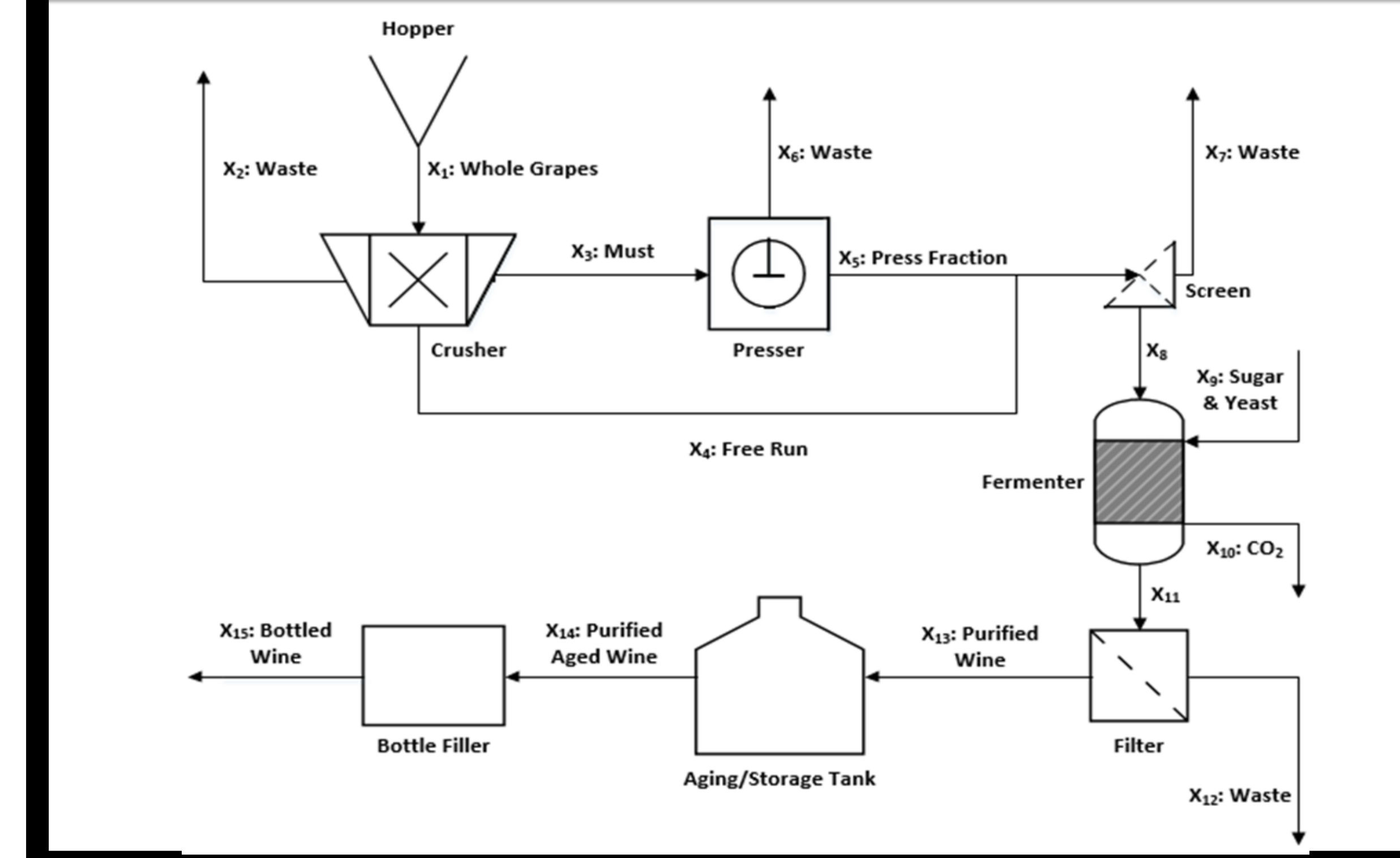
Impacts:

- Stimulation of local economy through local employment and use of local products
- Decomposable byproduct waste for minimal negative effect on environment

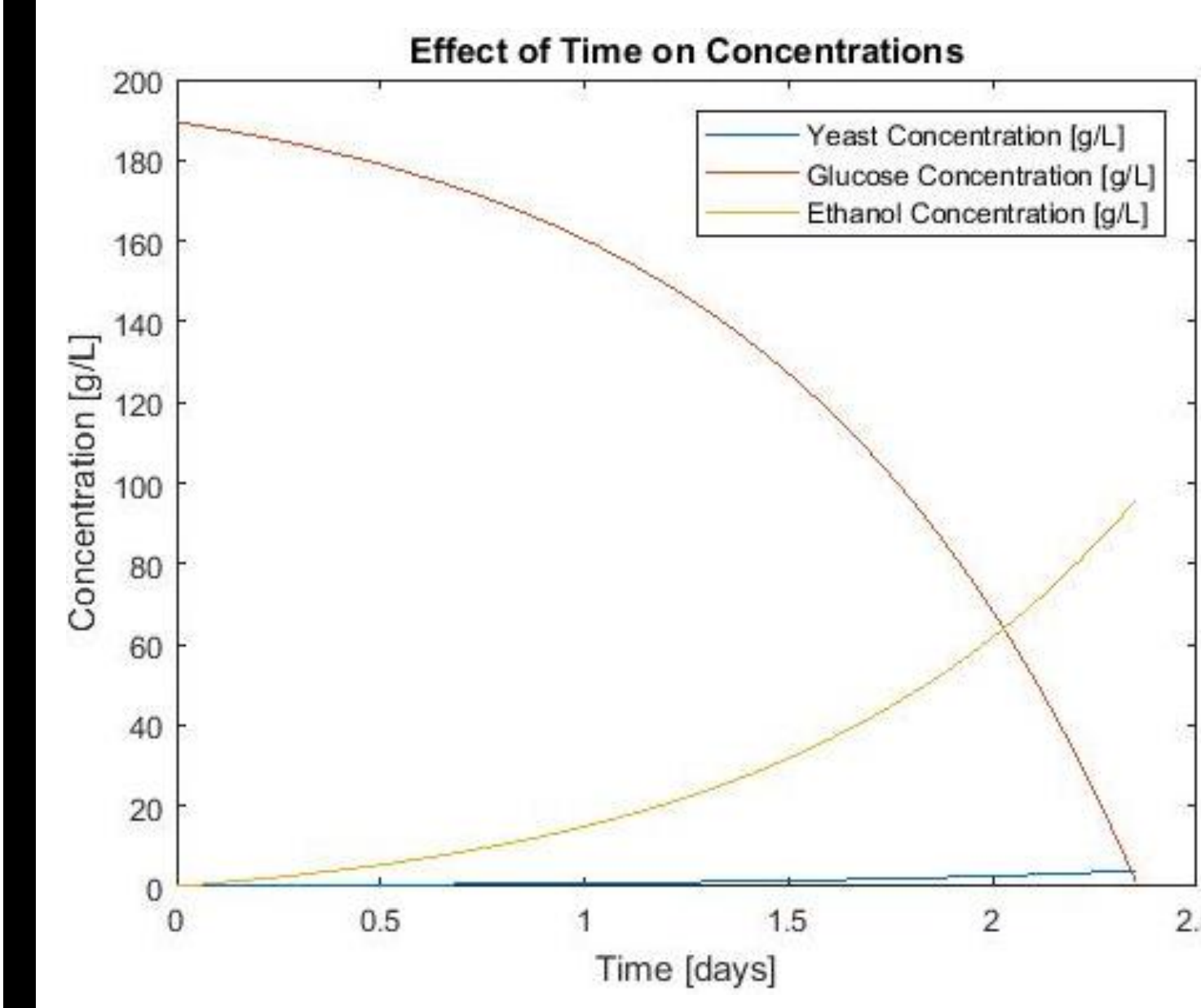
Sustainability:

- Materials: All fruit products can be obtained locally 6 months out of the year. Winter months grapes can be available from organic farmers in warmer climates.
- Life Cycle: Alcoholic beverage demand is consistent and growing as most millennials have reached legal drinking age

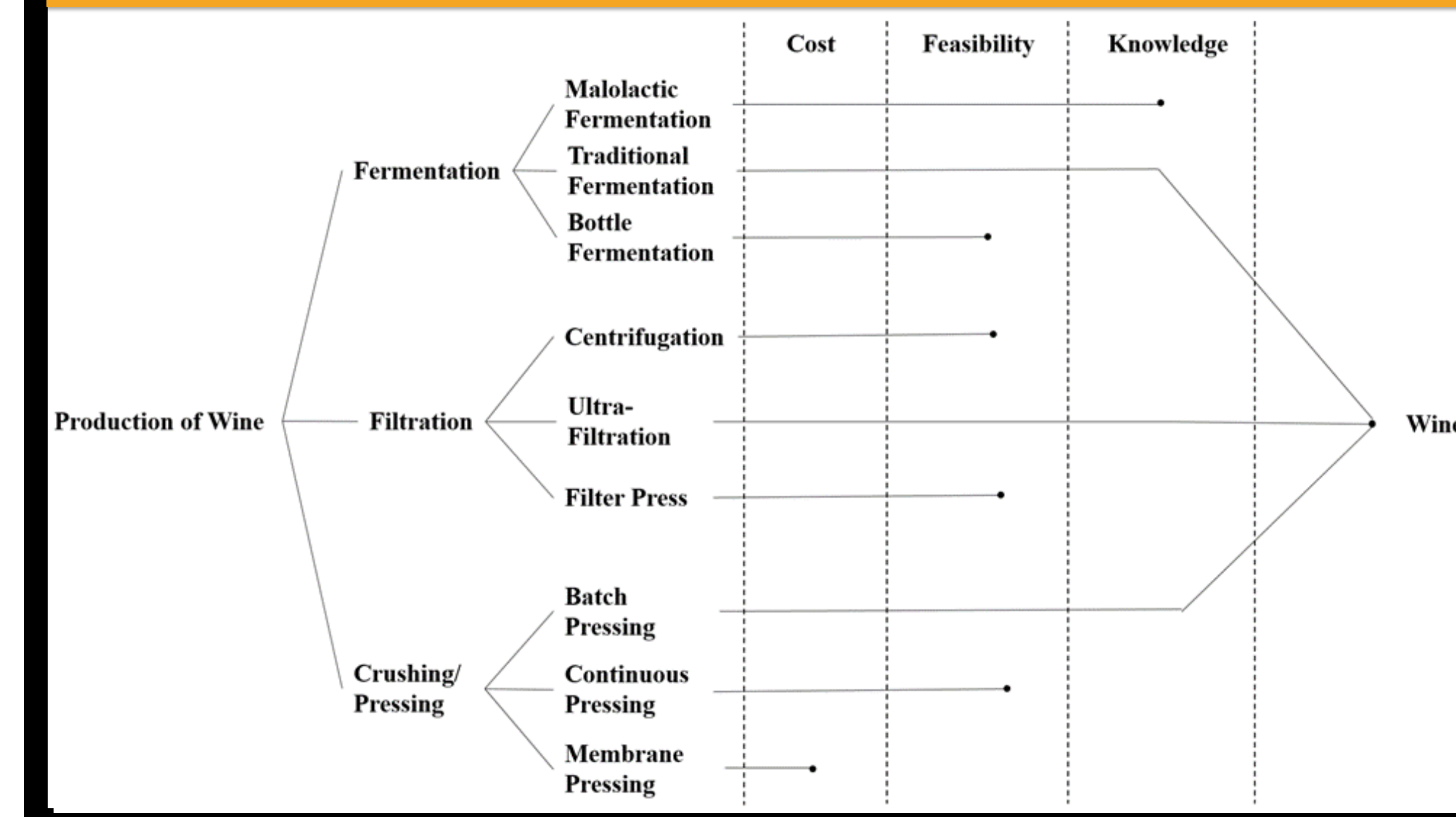
Process Flow Diagram



Fermentation



Morphological Analysis



Final Product

Wine Component	Composition
Juice (minus sugars)	89.15%
Ethanol	9.81%
Glycerol	1.04%

Production of Final Product	
Bottle Volume [L]	0.75
Unit Price Per Bottle [\$]	37.99
Bottles Sold Per Year [\$ per yr]	2970

Unit Operations	Optimized Variable	Minimized Parameter
Presser	Presser Volume	Annual Fixed Cost
Fermenter	Fermenter Volume	Annual Fixed Cost
Heat Exchanger	Heat-Exchanger Surface Area	Total Annual Cost
Piping System	Pipe Diameter	Total Annual Cost

Wine Recipe & Equipment (Lab Experiment)

- 3 gallons of Welch's grape juice or alternative fruit juice with no added sugar
- 1 tsp. yeast nutrients
- 1 yeast packet (~5g) *Saccharomyces bayanus*
- 1 6 gallon PET Carboy
- *No added granulated sugar due to the sweetness of juices



Economics

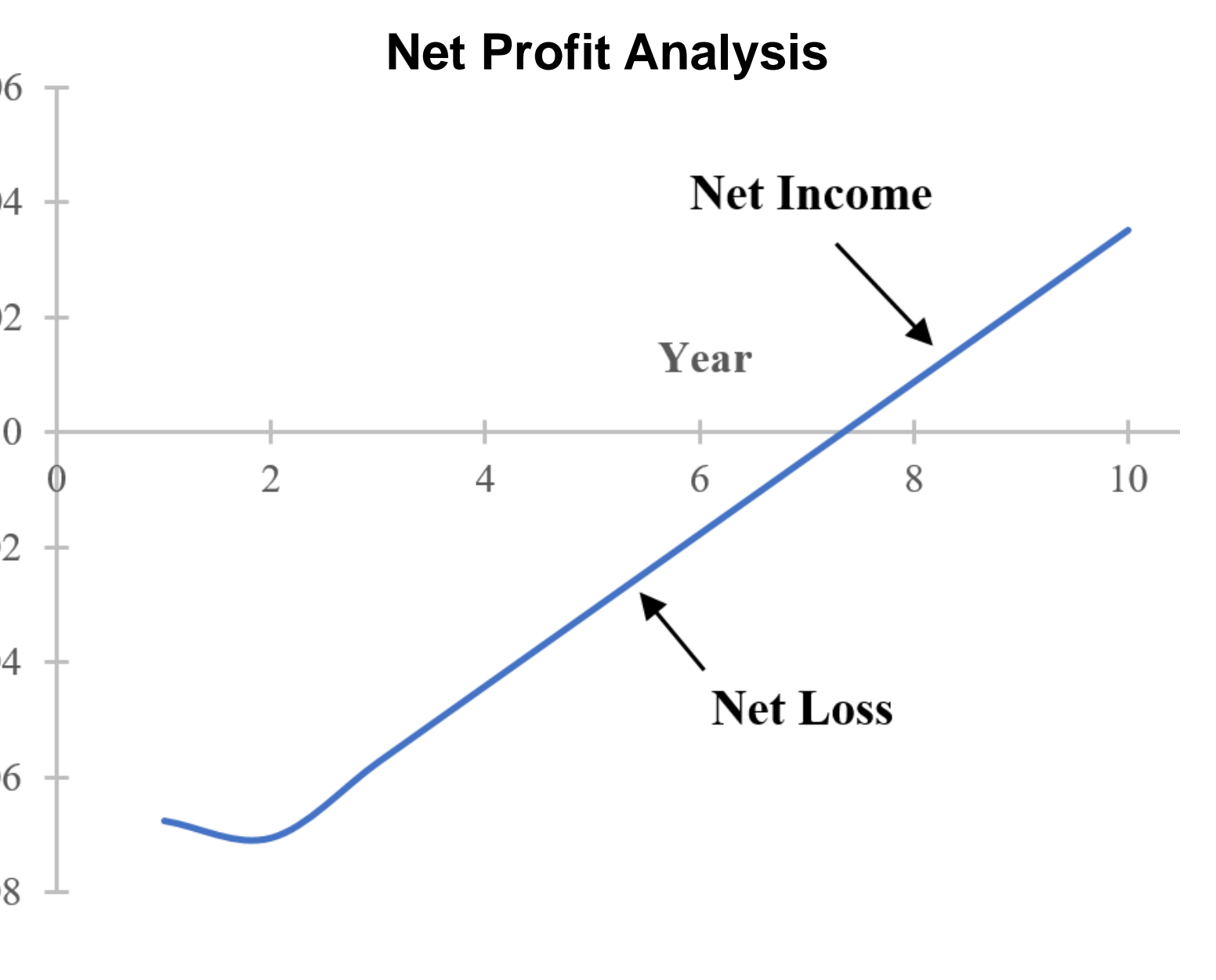
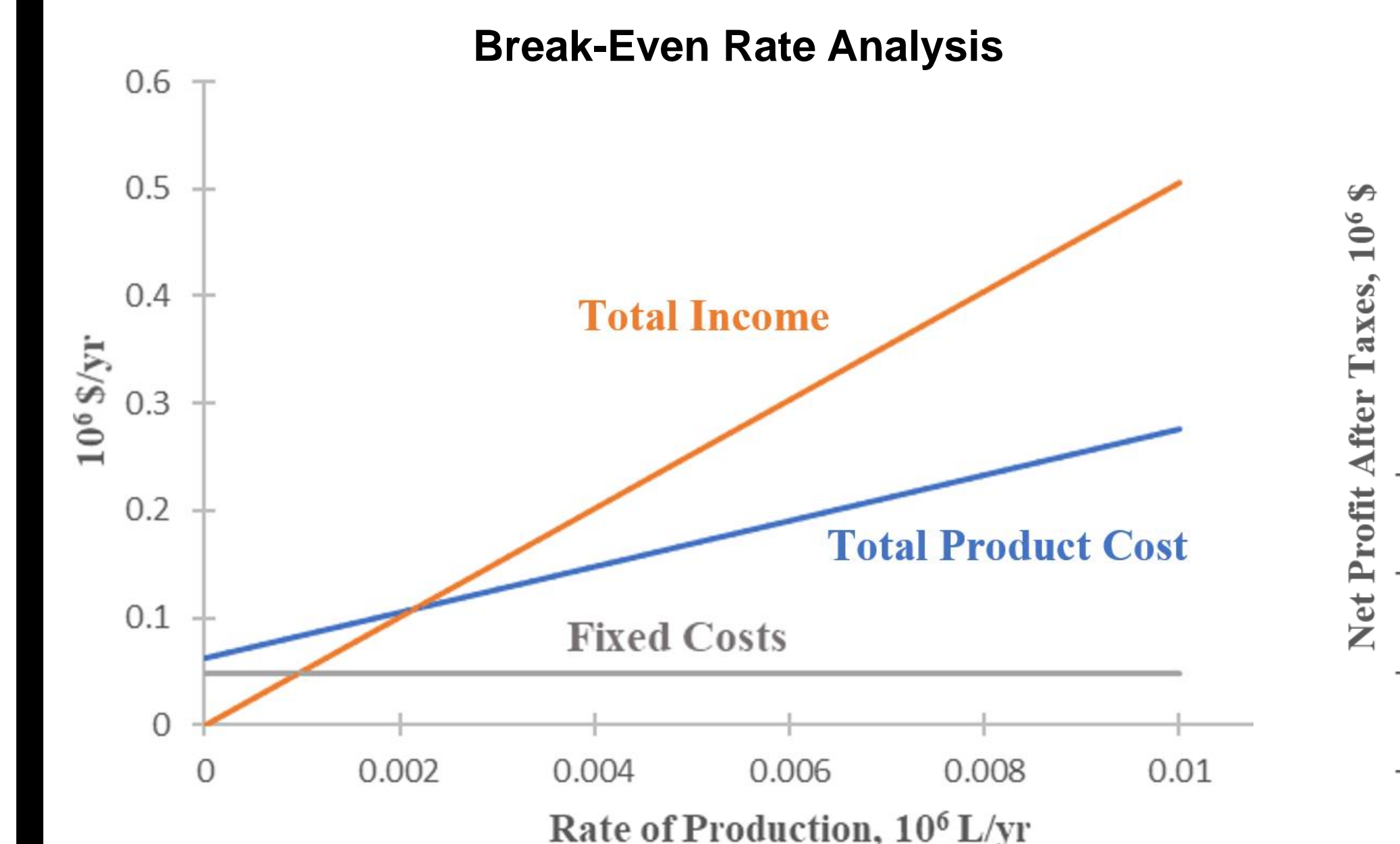
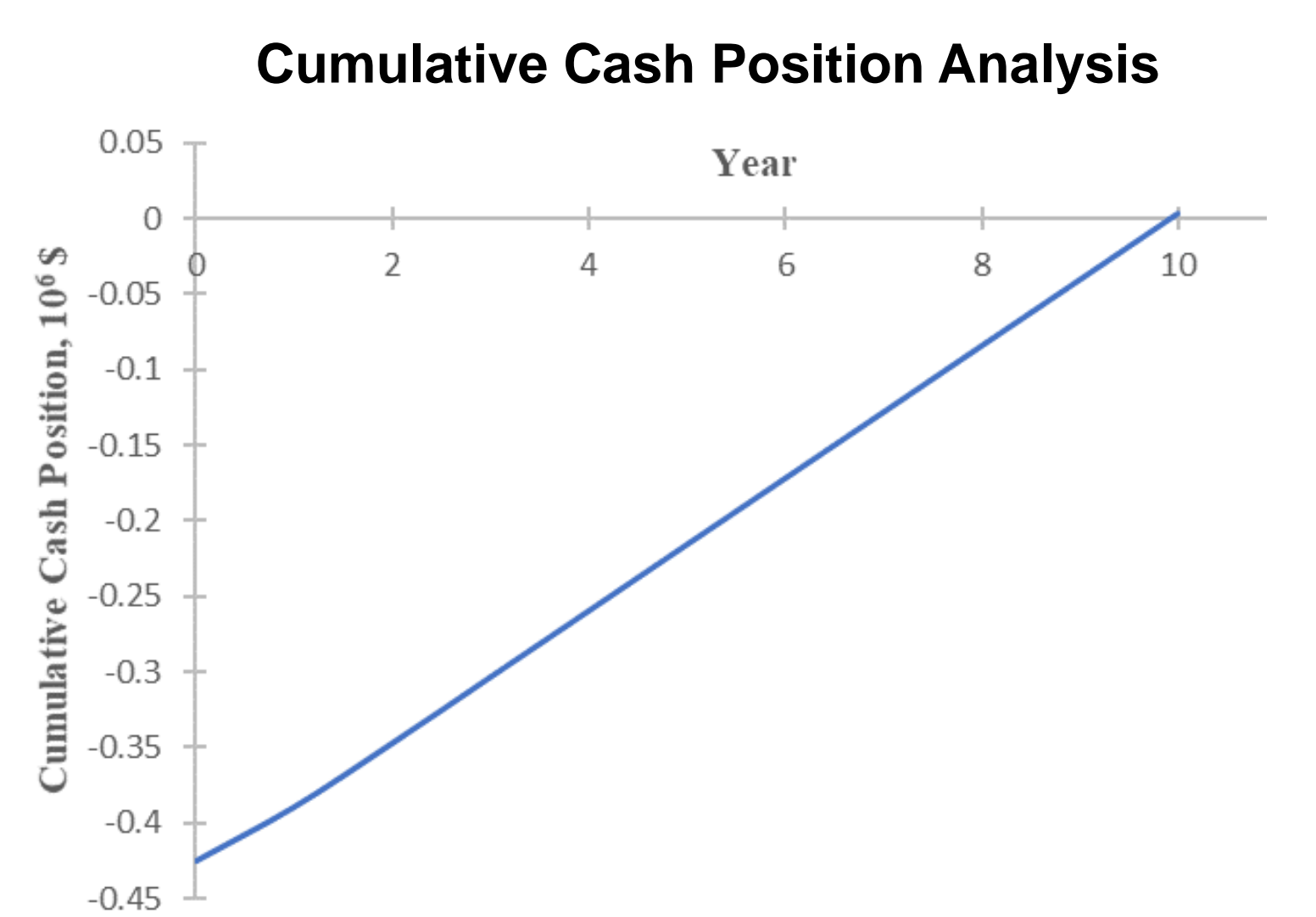
ANNUAL TOTAL PRODUCT COST			
Production Rate	2227.86	L per yr	
Product Price	50.65	\$ per L	
Fixed Capital Investment, FCI	362232	\$	
Working Capital	63475	\$	
Total Capital Investment, TCI	425707	\$	

Item	Percentage of Basis	Basis	Basis cost (\$ per yr)	Cost (\$ per yr)
Raw materials	10.00%	of product amount	112849	11285
Operating labor	10.00%	of product amount	112849	11285
Operating supervision	10.00%	of operating labor	11285	1128
Utilities	10.00%	of product amount	112849	11285
Maintenance and repairs	2.00%	of FCI	362232	7245
Operating supplies	10.00%	of maintenance & repair	7245	724
Laboratory charges	10.00%	of operating labor	11285	1128
Royalties	0.00%	of Total Product Cost	110819	0
Direct production cost = 44081				
Local Taxes	1.00%	of FCI	362232	3622
Financing (interest)	0.00%	of TCI	425707	0
Insurance	0.40%	of FCI	362232	1449
Rent	0.00%	of value of rented land and buildings	0	0
Depreciation (Straight Line: 10-yr)	10.00%	of TCI	425707	42571
Fixed Charges (11.19% of TCI) = 47642				
Plant overhead, general	50.00%	of labor, supervision, and maintenance	19658	9829
Packaging	0.80%	of product amount	112849	903
Plant Overhead = 10732				
Manufacturing cost = 102454				
Administration	20.00%	of labor, supervision and maintenance	19658	3932
Distribution & selling	2.00%	of Total Product Cost	110819	2216
Research & Development	2.00%	of Total Product Cost	110819	2216
General Expense = 8364				
ANNUAL TOTAL PRODUCT COST = 110819				

Equipment Cost [\$] = 84634		
Solid - Fluid Processing Plant		
Direct Costs	Ratio Factor	Cost [\$]
Purchased Equipment Delivered	100	84634
Purchased Equipment Installation	39	33007
Instrumentation and Controls	26	22005
Electrical Systems	10	8463
Buildings	29	24544
Service Facilities	55	46549
Indirect Costs		
Engineering and Supervision	32	27083
Construction Expenses	34	28775
Legal Expenses	4	3385
Contractor's Fee	19	16080
Contingency	37	31314
Fixed-Capital Investment	428	362232
Working Capital	75	63475
Total Capital Investment	503	425707

Break-Even Chart				
Product Price (\$ per L)	50.65			
Production Rate [L per yr]	2227.86			
Break-Even Rate [L per yr]	2158.18			

Production Rate [L per yr]	Total Product Cost [\$ per year]	Fixed Cost [\$ per year]	Total Income [\$ per year]	Gross Earnings [\$ per year]
0	63211	47642	0	-63211
1000	24580	47642	50653	-33927
2000	10590	47642	101307	-4643
2227.86	110819	47642	112849	2030
3000	127319	47642	151960	24641
4000	148658	47642	202613	53925
5000	170058	47642	253267	83209
10000	276905	47642	506533	229629



Recommendations

- Continue experimenting with original fermentation feed with higher sugar contents to enhance final taste and increase residual sugar content
- Continue refining separation and filtration processes to decrease wine cloudiness
- Continue analyzing production rates and operation times to increase efficiency and overall profit