



GNG 2101 – Introduction to Product Design and Development

Design Deliverable 2

Group F1.3

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## **Introduction**

This report provides an economic analysis and intellectual property report on the product and design. Based on the assumption that the proposed cane design is in production/on the market, cost breakdowns such as the fixed/variable/direct table are used to analyze overall expenses. A mock income statement for a 3-year term is created to analyze cash flow and an NPV analysis is conducted to determine the breakeven point over the same term.

## **1.0 Economics Report**

**1.1 Include a list of variable/fixed, direct/indirect, and material/labour/overhead costs associated with your business, based on the manufacturing and sale of your product. Make sure that you distinguish between price and cost and realize that prototyping and higher-volume manufacturing costs will probably be different.**

Table 1: Variable and Fixed Costs

Variable	Direct Costs	Material Costs	\$2600/tonne	<a href="#">link</a>
		3D Printing Expenses	\$3000/100kg	<a href="#">link</a>
		Packaging Materials	\$550 – \$950	<a href="#">link</a>
		Shipping Costs	\$5000	<a href="#">link</a>
		Labor Costs	\$208,000/year	\$20/h for 5 employee
	Variable Indirect Costs	Marketing Costs	\$5,000–\$10,000	<a href="#">link</a>
		Utilities	\$700-\$1000	<a href="#">link</a>
		Maintenance & Repairs	\$2000	Rough estimate
Fixed Costs	Fixed Direct Costs	Initial Tools & Equipment	\$50000-\$80000	<a href="#">link</a>
	Fixed Indirect Costs	Rent	\$7,880–\$15,760	<a href="#">link</a>
		Business Registration & Legal Fees	\$500	<a href="#">link</a>
		Insurance	\$500-\$1500	<a href="#">link</a>

**1.2 Develop a 3-year income statement, which includes sales revenue and costs of units sold for each year, gross profit, operating expenses and operating income (no need to include interest and taxes)**

Assumptions:

- Selling Price per Cane = \$150
- Growth: 5% each year
- Sales Projections:
  - o Year 1: 6000
  - o Year 2: 6300
  - o Year 3: 6615
- Materials (per cane): \$63
  - o Raw Materials (aluminum): \$26
  - o 3D Printing Expenses: \$30
  - o Packaging: \$7
- Fixed costs: \$259,000
  - o Labour (40 hours a week) = \$20 / hour
    - \$41,800 / year / employee
    - \$209,000 / year
  - o Facility lease = \$50, 000 / year
  - o

Table 2: Three Year Income Statement:

	Year 1 (\$)	Year 2 (\$)	Year 3 (\$)
<b>Revenue</b>			
Sales (Units)	6000	6300	6615
Price Per Unit	150	150	150
Total Revenue	900,000	945,000	992,250
<b>Cost of Goods Sold</b>			
Direct Materials	378,000	396,900	416,745
<b>Gross profit</b>	522,000	548,100	575,505
<b>Operating Expenses</b>			
Fixed Costs	259,000	259,000	259,000
<b>Net income</b>	263,000	289,000	316,000

**Calculation Summary:**

- Revenue = Sales(units) \* Price per Unit
- Direct Materials = Sales (units) \* Material Cost per Cane
- Gross Profit = Revenue – Direct Materials
- Net Income = Gross Profit – Fixed Costs

**The numbers are based off the average profits and costs of an accessibility aid product company with 5 employees.**

**1.3 Using a NPV analysis, determine the break-even point (i.e. number of units that must be sold for your business to become profitable). Note: It is highly unlikely that your operating income will be positive in the first year because of fixed costs. Therefore, you must use a NPV analysis to compare costs and profits over multiple years based on present value. Draw two cash flow diagrams of the expenses and incomes for the next three years. Calculate the NPV value of each expense/income and determine the differences and then the break-event point.**

Assumptions;

- 10% discount rate

$$PV = \frac{C}{(1 + r)^t}$$

Table 3: Present Values of Yearly Income

Year	Operating income	Present value
1	\$263,000	\$239,090.91
2	\$289,100	\$238,925.62
3	\$316,505	\$237,739.06
total		\$715,755.59

$$\text{Break Even Units} = \frac{\text{Fixed Costs}}{\text{Selling Price} - \text{Variable Cost}}$$

$$\text{Break Even Units} = \frac{259,000}{150 - 63}$$

$$\text{Break Even Units} = 2,977$$

Therefore, 2977 Canes must be sold to break even. This is expected to be reached in the first year.

### Cash Flow Diagrams:

Figure 1. Cash Flow Diagram for Year 1

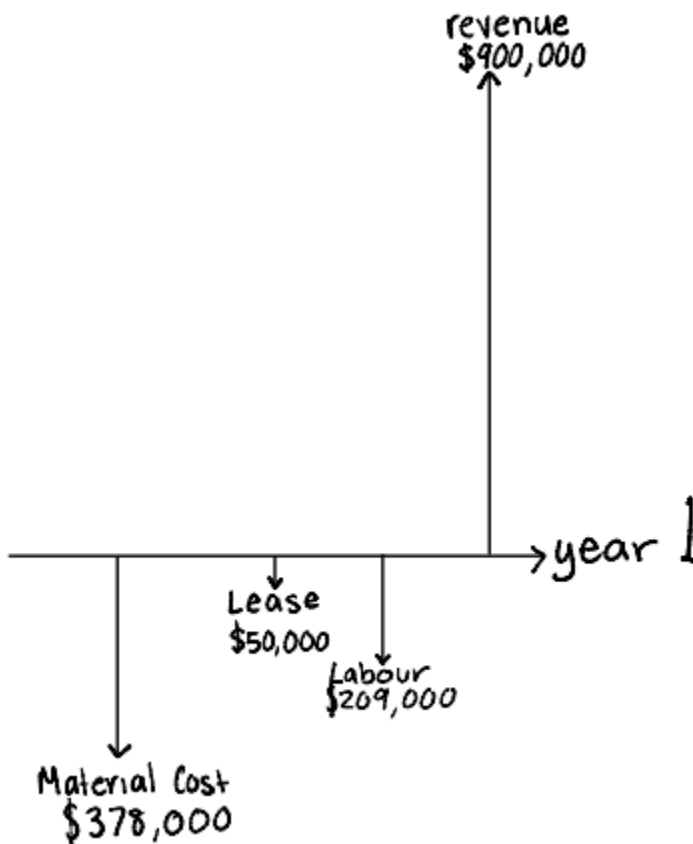


Figure 2. Cash Flow Diagram for Year 2

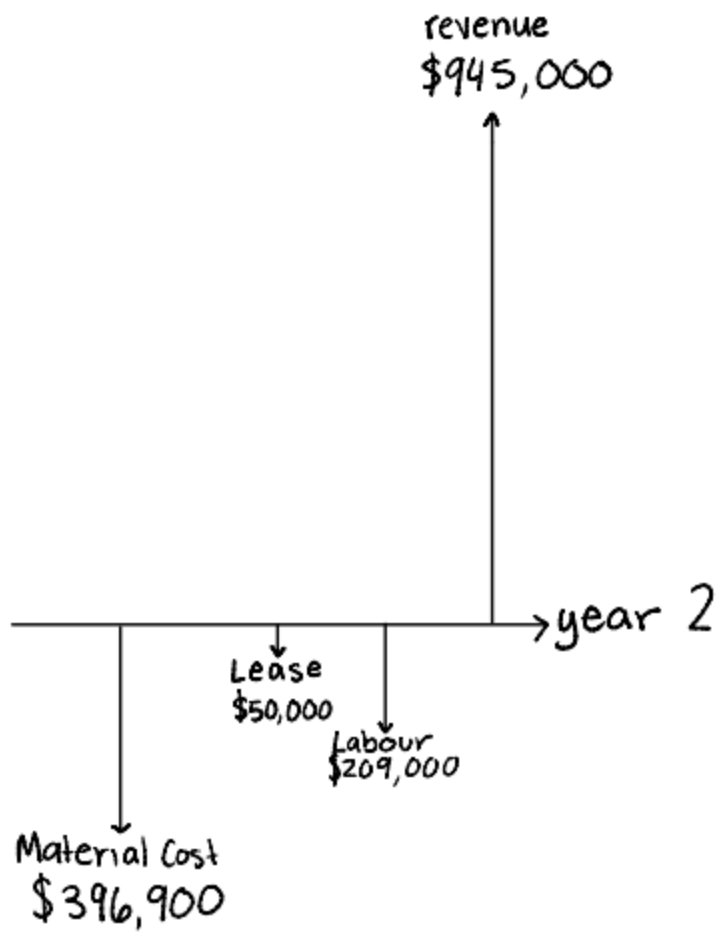
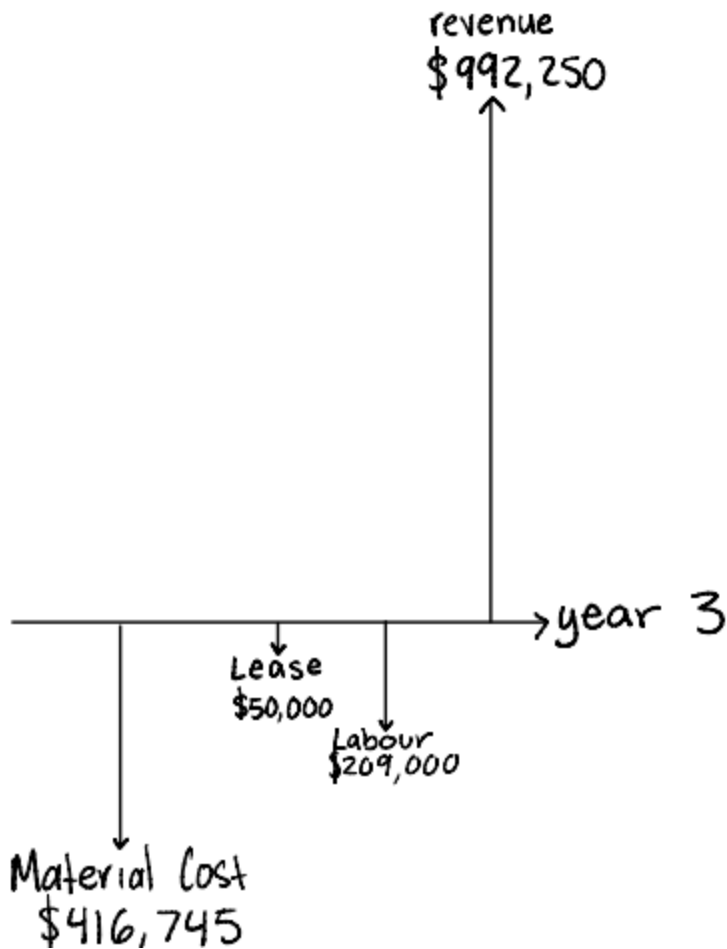


Figure 3. Cash Flow Diagram for Year 3



**1.4 Describe and justify all assumptions that you have made in developing your economics report. The assumptions must be factual based on a preliminary market research that you conduct in order to determine the amount of demand in your target market, the expected % of the market that you would own, and the unit price of your product based on a sound pricing strategy.**

These assumptions are based on market research for the Ottawa region.

#### **Target Market Size**

- Ottawa has 172,150 seniors (17% of the population) and 90,000+ mobility-impaired individuals.
- About 5,000 canes are estimated to be sold annually in the Ottawa region.
- Our business aims to capture 5% of local market share (250–500 units in Year 1).



## **Sales Assumptions**

- Initial Production Volume: 6,000 units
- Annual Growth Rate: 5%
- Break-Even Target: 2,977 units (achieved in Year 1)

## **Pricing Assumptions**

- Standard folding canes retail between \$40-\$70 in Canada. Premium canes (carbon fiber, ergonomic) sell for \$100-\$150.
- The product's \$150 price point is competitive for a high-quality aluminum folding cane.

## **Cost Assumptions**

- Materials: Aluminum price of \$2,600/tonne and 3D printing filament at \$3,000/100kg reflect real supplier pricing.
- Labour: Based on Ontario's industrial manufacturing wages (\$20/hour).
- Rent: Small industrial space in Ottawa costs between \$7,880-\$15,760 per year.
- Marketing: Initial marketing budget of \$5,000-\$10,000, focusing on e-commerce and local pharmacy partnerships.

## **Conclusion**

- At a \$150 price point, the business is profitable in Year 1.
- Break-even at 2,977 units, which is achievable in Year 1.
- Expected Net Income:
  - Year 1: \$263,000
  - Year 2: \$289,000
  - Year 3: \$316,000
- **Growth Strategy:**
  - Increase sales volume by expanding distribution channels.
  - Target national sales via online platforms.
  - Introduce premium variants (\$180+ models).

## **2.0 Intellectual Property Report**

### **2.1 Intellectually Property Databases**

#### *2.1.1 Compact Folding Cane (United States Patent Application 20200008545)*

This cane made in the United States features foldable technology to reduce the size, and also has a base that the user can step on to assist with compacting and using the cane. This design is similar to the product this team is building in the sense that they can both be compacted, and they both feature a base that the user will step on during use.

Link to patent: <https://www.freepatentsonline.com/y2020/0008545.html>

#### *2.1.2 Compact Folding Cane (United States Patent 10863803)*

This cane features a folding mechanism that utilizes two cane segments, a handle, and a tip. It is similar to our product in structure, but differs in folding technology. It is also incredibly similar to the previous compact folding cane patent.

Link to patent: <https://www.freepatentsonline.com/10863803.html>

#### *2.1.3 Telescopic Walking Cane*

This patent features a cane that utilizes a telescopic collapsing technology, similar to our own. It also features spring-loaded technology, an extension mechanism considered by our team when designing our cane. It also features a thermometer and a light to assist the user.

Link to patent: <https://www.freepatentsonline.com/3987807.pdf>

## 2.2 Explain the importance of these intellectual properties and the legal constraints they place on developing your product or business.

### Project Plan Update



### Conclusion

By assuming the product and design were in production/on the market, a fixed/variable/direct table was created by outlining possible cost associated with large-scale production. An income statement created for the given 3-year period shows that the net income for Year 1 at \$263 000, Year 2 at \$289 000, and Year 3 at \$316 000, as well as an NPV analysis conducted for the same period as well. All assumptions used within the report are justified and described within section 1.4. An intellectual property study was also conducted where 3 similar products were referenced in the creation of our product with their patents listed as well.