GNG 2101[D]
Project Deliverable F:
Business Constraints

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Table of Contents

1.0 Introduction

In this deliverable, the team creates a business model including a sustainability report, an economics report regarding the business and an intellectual property overview of the design. The client expressed a need for a wheelchair backpack transfer device that would transfer a backpack from the back of a wheelchair to the side of the wheelchair, where it would be more accessible to her. The business model was created based on the Business Model Canvas. The Economics report includes fixed and variable costs, a three year income statement, a break even analysis, and states the assumptions made when coming up with figures. The intellectual property report includes two patent designs for wheelchair storage transfer devices and covers the implications intellectual property has on our design. The Wrike overview has been updated to include upcoming tasks, dependencies, and goals.

2.0 Business Model and Sustainability Report

2.1 Business Model

For our project, our group chose to use an Empathic design method. The project started with customer needs, because of this our group needs to use a lot of empathy to help design a product. This is made more challenging since no member of our group has experienced what our client has. Luckily our client has given us wonderful feedback. This method starts off with a client need, then generates an idea to solve that need. After the idea is generated, the idea is iterated on. This iteration process is helped along by feedback from the client.

<table>
<tr><td rowspan="2">Key Partners:

- Manufacturers

- Part suppliers

- Wheelchair companies</td><td>Key Activities:

- Manufacturing.</td><td rowspan="2">Value Proposition:

- Ability to access their backpack

- Autonomy</td><td>Customer Relationships:

- Direct relationship with users

- Wheelchair companies can offer products as an add on.</td><td rowspan="2">Customer Segments:

- Users

- Wheelchair companies</td></tr>
<tr><td>Key Resources:

- Parts

- Access to a workshop</td><td>Channels:

- Sales team

- Installers</td></tr>
<tr><td colspan="3">Cost Structure:

- Development costs

- Manufacturing costs (most likely fixed)</td><td colspan="2">Revenue Streams:

- Sales</td></tr>
</table>

- Marketing / Sales	
Social and Environmental Cost: - Possible pollution of the environment (if not disposed of correctly).	Social and Environmental Benefit: - Increase the happiness of many wheelchair users.

Triple bottom line business model canvas.

2.2 Sustainability Report

The presence of a wheelchair backpack transfer device allows the client to transfer the backpack from the back of the wheelchair to the side without turning around, which facilitates the process of picking up the backpack. However, for the sustainability of the product, the team focused on the social and environmental impact.

2.21 Social Impact

Wheelchair backpack transfer devices have the potential to have a significant positive social impact on people who use wheelchairs. With a transfer device, individuals who use wheelchairs can independently transfer their backpacks or other personal belongings to their wheelchairs without the assistance of others. This can increase their sense of independence and autonomy, which can have a positive impact on their self-esteem and overall sense of well-being. At the same time, transfer devices can also make it easier for people who use wheelchairs to get around because they can carry their personal belongings more easily. Thus, using a backpack transfer device can increase their ability to participate in social activities, such as going to school or work, or as well as engaging in other daily activities. However, the wheelchair transfer device also has negative social problems. The team's client had repeatedly stressed whether the device would interfere with the normal use of the wheelchair and whether it would inconvenience people or things around it. The size of the wheelchair had to be increased because the device was set to be mounted on the outside of the wheelchair. There is a lot for the user to consider as they prepare to pass through the narrow door frame, which can easily cause anxiety for the client.

2.22 Environment Impact

The environmental impact of the wheelchair backpack transfer device was one of the factors our team considered at the beginning of the design process. The main components of the wheelchair backpack device include a curved conduit, wire, pulley set and fixtures. Considering the durability and recyclability of the conduit, the team chose aluminum tubing as the material. At the same time, a metal alloy coated with plastic was chosen as the pulley's wire. This conductor is not usually sustainable friendly and the client needs to be careful when disposing of the product. The team used a 3D printer with PLA as the raw

material to create the pulley set and fixtures. While PLA is recognized as a biodegradable plastic, the stark fact that current recycling facilities are not equipped to handle bioplastics means that recycling technology is far from perfect. The team therefore generates as little waste as possible and tries to recycle any filament material that can be recycled.

3.0 Economics Report

Economic considerations must be made in order to produce a Wheely Good Transfer Device. Fixed, variable, direct, and indirect costs factor into overall production costs, which increase the overall purchase price of the device. An income statement, cash flow statement, and net present value analysis is also created in this section.

3.1 List of Costs

The List of Costs is created under the assumption that Wheely Good Transfer Device has achieved higher-volume manufacturing capabilities.

3.1.1 Fixed Costs

Fixed costs include costs which are independent of production output.

- Building rental ~$3,642 for 1900 sq. ft.
- Insurance - About $900/year
- Salaries unrelated to production output
    - Human Resources labor - Average $61,976/year
    - Accounting labour - Average $59,167/year
- Phone and Internet - $79.97/month (Bell)

3.1.2 Variable Costs

Variable costs include costs which depend on production output.

- Material usage
    - Steel pipe - $8.99 per 36" (approximately one devices' worth)
    - 3D print filament - $24.95 per 1kg spool
    - Spray paint/coating - $13.87 per can
    - Packing materials - $19.49 per 100' of bubble wrap
- Electricity usage - First 750kWh, 8.7 ¢/kWh; 10.3 ¢/kWh after

3.1.3 Direct Costs

Direct costs are costs which are associated with a specific project; in this case, the production of the transfer device.

- Manufacturing labour - Average $42,359/year
- Maintenance labour - Average $92,797/year
- Manufacturing Material
    - Steel pipe - $8.99 per 36" (approximately one devices' worth)
    - 3D print filament - $24.95 per 1kg spool
    - Spray paint/coating - $13.87 per can
    - Packing materials - $19.49 per 100' of bubble wrap

3.1.4 Indirect Costs

Indirect costs are costs which are independent of specific projects. Indirect costs can also be referred to as “overhead."

- Building rental ~$3,642 for 1900 sq. ft.
- Phone and Internet - $79.97/month (Bell)

3.1.5 Material Costs

Material costs are an example of variable costs, as the amount of materials used depends on production output.

- Steel pipe - $8.99 per 36" (approximately one transfer devices' worth)
- 3D print filament - $24.95 per 1kg spool
- Spray paint/coating - $13.87 per can
- Packing materials - $19.49 per 100' of bubble wrap

3.1.6 Labour Costs

Labour costs can be an example of a fixed cost or direct cost, depending on the nature of the work. If labour is supplied for a specific project, then it is a direct cost. Assuming Wheely Good Transfer Device is not currently in need of project-specific labour, the listed labour costs are fixed.

- Manufacturing labour - Average $42,359/year
- Maintenance labour - Average $92,797/year
- Shipping/Receiving labour - Average $43,633/year
- Human Resources labor - Average $61,976/year
- Accounting labour - Average $59,167/year

3.1.7 Overhead Costs

Overhead costs are costs which are independent of specific projects. Overhead costs can also be referred to as “indirect."

- Building rental ~$3,642 for 1900 sq. ft.
- Phone and Internet - $79.97/month (Bell)

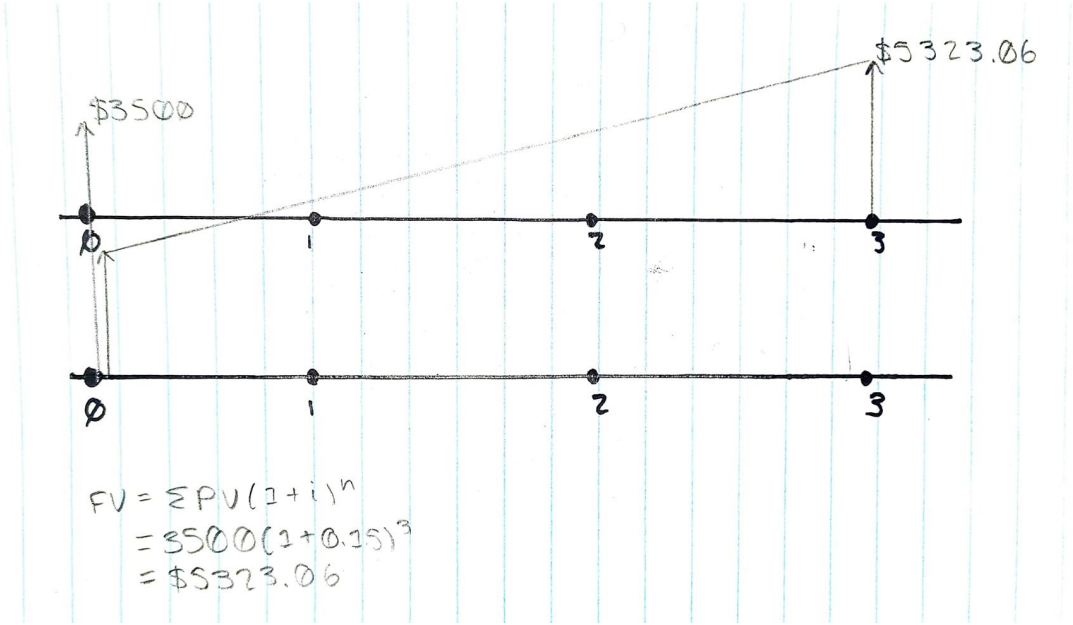
3.2 Three-Year Income Statement

Income Statement (2020 - 2022) for Wheely Good Transfer Device

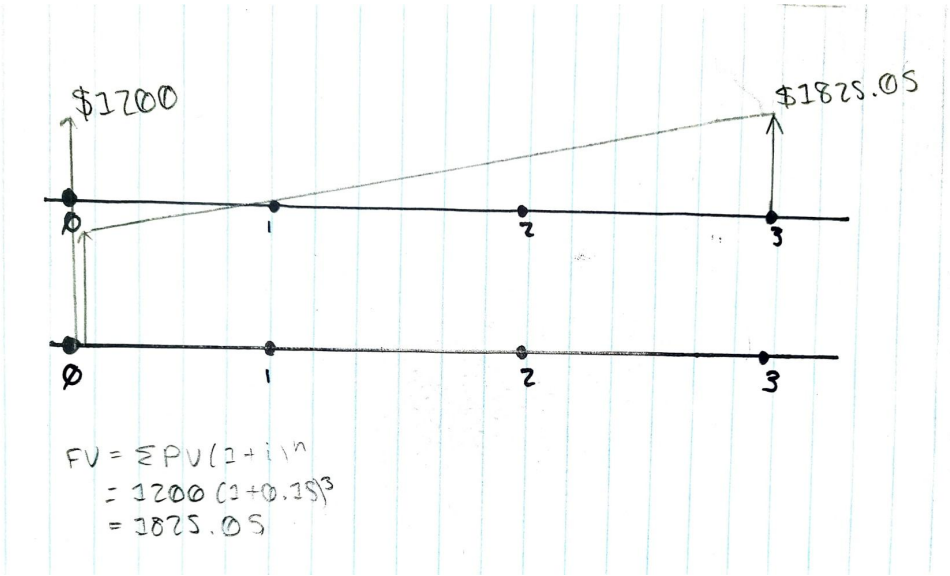
	2022	2021	2020
Sales	$3,500	$2,700	$1,800
Cost of Goods Sold	$2,900	$2,400	$2,200
Gross Profit on Sales	$600	$300	($400)
Operating Expenses			
Marketing Expenses	$150	$130	$120
General and Admin Expenses	$150	$150	$150
Depreciation	$10	$10	$10
Net Income	$300	$20	($670)

3.3 Break-Even Point

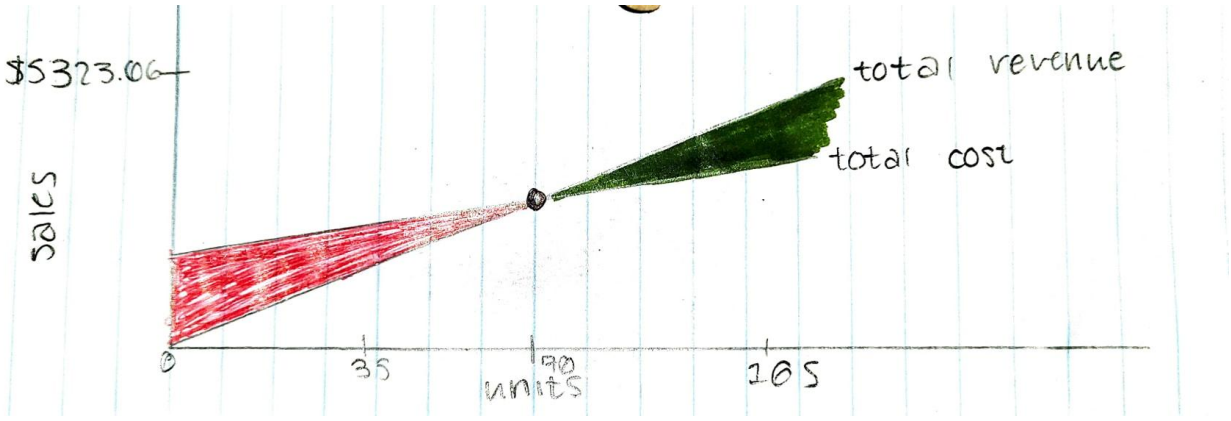
For future income, using the assumed current profit of $3500 and a hypothetical growth rate of 15%:



For future expenses, using the assumed current expenses of $1200 and the same growth rate of 15%:



Graphing out the point of intersection between the total revenue and total cost of the transfer device over the course of three years, found by using Desmos:



Wheely Good Transfer Device will break even at approximately 70 units sold.

3.4 Assumptions

The assumptions made for the economics report portion were made after some preliminary market research. For business costs, research was done to find the average salaries of various professions, materials, and utilities local to Ottawa or Ontario. For the income statement, broad assumptions were made about hypothetical sales and expenses. As stated during class, it is unlikely that companies will make profit during their first year in business; the income statement reflects this. Additionally, some growth is shown after the first year, and expenses (such as admin expenses and marketing expenses) increase to match the rise in profits. The income statement values were used in the NPV analysis, where a 15% annual growth rate was hypothetically assumed (the average annual company growth rate is between 15% and 45%, however, we chose to err on the side of caution.) Desmos was used to calculate the point of intersection for the NPV.

4.0 Intellectual Property Report

Intellectual properties protect an individual or group's creatively produced unique works. It prevents others from claiming ownership and profiting off of their ideas.

4.1 Two Intellectual Properties

4.1.1 Intellectual Property I

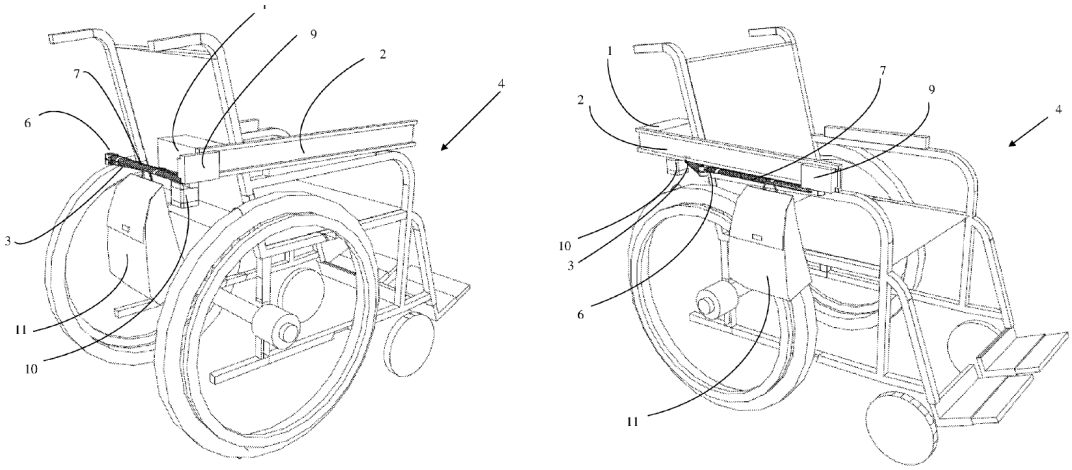


Figure 1. Patent US7845667B2

The patent shown in Figure 1 was finalized on December 7, 2010. The design is for a device that involves two arms, a sliding mechanism and multiple pivot points in order to move a bag from the back of a wheelchair to the side.

4.1.2 Intellectual Property II

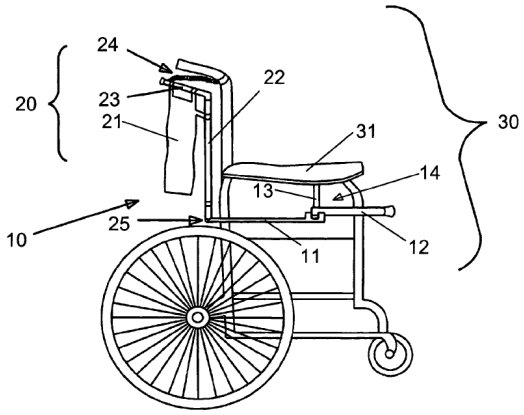


Figure 2. Patent US7344055B2

The patent shown in Figure 2 was finalized on March 18, 2008. The design is for a device that relocates a storage device from the back of a wheelchair to the side of a wheelchair by rotating the bar where the storage device is sitting around a central axis.

4.2 Importance and Legal Constraints

It is important when developing a product to be aware of another's intellectual property. Failure to do so may result in legal complications. Such legal implications include a payout to the owner of the property, a legal order to stop infringing on another's work, and possibly jail time.

There is also an ethical component to not infringe on another's intellectual property. Knowingly infringing on someone's intellectual property is dishonest. Unknowingly infringing on someone's intellectual property may not be dishonest, however it may cause harm to others.

The team must be aware of similar products which are the intellectual property of others, in order to avoid the legal and ethical implications of intellectual property infringement. Neither of the found patents are infringed upon as both of the arms involve a mechanism that pivots to allow movement from the back of the wheelchair to the side.

5.0 Project Plan Update

The Wrike plan was updated to include assignments, milestones, and due dates. Click here for a link to the Wrike.

6.0 Conclusion

In this deliverable, the team chose to use an empathy design approach to build a triple bottom line business model canvas, with two key social and environmental factors mentioned in the sustainability report. In this deliverable the team also developed an economics report that included fixed costs, variable costs, a three-year profit and loss statement, and a break-even analysis, and explained the assumptions made in the resulting data, which effectively helped the team understand the economics of the product and further demonstrated the marketability of the wheelchair backpack device. The team then listed two related product IP patents and outlined the importance of IP and legal constraints. As always, the Wrike was updated to reflect completed tasks and upcoming tasks.