Project Deliverable F
Business Constraints

GNG2101 [D]
Introduction to Product Development and Management for Engineers and Computer Scientists

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Introduction

In this report, our team will go into detail on the business model we believe could be successful for this product. We will discuss the sustainability of this product and we will discuss the who, what, where, when of this product. In addition to this, we will outline the economic costs of material, labour and manufacturing and estimate the amount of time it would take us to profit from this business. Finally, we will also complete an investigation into current trademarks, copyrights and patents to determine if we have any conflicts which could incur legal or financial penalties if this product were to be released into the market.

Business Model and Sustainability Report

Business Model

For this product, we believe the reverse razor blade business model would be a viable business model to successfully launch and profit from this design. The reverse razor blade model tries to sell the product up-front for a high cost and then make smaller accessory-based options available for purchase at a lower cost. Our aerobic workout device has a couple of different accessory options that can be sold. The first is the spring. The point of the spring is to help the injured/under-developed arm gain muscle by aiding the arm during the movement. Once the arm begins to recover/properly progress, less force needs to be exerted by the spring. This leads to a need for a weaker spring to help the arm continue progressing further. We would then be able to sell these different springs to the user. The second customization possibility is the platform. The shoulder will cause lots of wear and tear on the platform which will eventually wear out the cushioning. This will lead to the need to replace the cushioning. In addition to the wear, some people may want a stiffer/softer type of cushioning on the platform which adds to the need to sell different types of platform coverings.

Triple-Bottom Line Diagram

Key Partners	Key Activities	Value Proposition	Customer Relationship	Customer Segments
Right partnership agreement ● We'll distribute our product to different stores that sells workout equipment such as Fitness Depot and Gorilla Fitness ● We'll give reasonable values to the companies that helps our product to be sold throughout different cities/country Social media influencer/Brand partner ● We'll be marketing through brands names and through social media influencers which will help our product to be known through different country	App/website development ● Having an website/app that our customer use to see what we service Improving our product/Delivery ● Our employees will delivery the product to the customers and our product we improve to the liking of our customers Customers's feedbacks ● The product will be improved base on the customers's feedbacks Design manufacture ● Creating more designs that will solve customers problem	Cost-Reduction ● When customers are trying to get a different spring or different type of platform, the cost will be reduced based on what they can afford Performance ● Our product will have new features that satisfied our customer's needs in every couple of years Risks ● Our product will continue to have aspects that ensure the safety of our customers Customization ● Our product can be easily made as the way our customers wants it to be	Long-term ● We'll serve our customers as long as they want and our goal is for our customers to leave us with better conditions Personal assistance ● Our employees will establish good term relationships with our customers Dedicated personal assistance ● Customers will be assigned to assistance that will talk with them about their health and their progress with the product	● For people who struggle and have a hard time doing push-ups ● The product is for anyone that can't do symmetric exercises ● People that have problems with their shoulder/arm ● People who got their arm hurt accidentally ● People who were born with a disabled arm that needs help

	Key resources Physical ● Marketing resources ● Product development team Intellectual ● Our company will have patents and trademarks		Channel Owned Direct ● The product will be solved through our own market and our known service ● Customers will reach us through our website/app ● Customers can experience the service we provide in person and online	

Cost Structure	Revenue Streams
● Marketing ● Creation of app/website ● Partnership ● Creation of product ● Overhead ● Staff ● Technical infrastructure ● Rent for working space	● Direct sales ● Customization of spring/platform covering ● Point of sale transaction ● Private assistance fee ● Retail Sales

Business Model Assumptions

During the development of our business model, we needed precise assumptions to determine what business model would be beneficial. Our assumptions revolved around the type of people our product would attract, the number of people who would actually buy it and the number of items these clients would buy. Our first assumption about who would buy this product was veterans who suffered arm injuries, physiotherapists, gyms and any client who may have suffered an arm injury. According to Hanger Clinic, over 2 million Americans have suffered limb loss with 28 million at risk of losing a limb [1]. Assuming 50% of these limb losses are upper limbs such as the arm and using Statista estimate that 21.5 % of the US population participate in sports/exercise daily [2], we can safely assume that we could potentially have 430 000 public clients on top of the 108 297 gyms across the United States in 2020 [3] and the 119 552 physiotherapists in the United States in 2020 [4]. In total, we could at most have 657 849 total clients. Assuming 50% of the veteran/amputee clients, 75% of the physiotherapists and 20% of gyms purchased our device, we better approximate our

total clients to about 326323 separate clients. Since this number is not a very large number and we assume each client only needs to buy the device once, we need to have cash flow coming in from the start which means we need a high upfront cost. This helped us pick the reverse razor blade model since we will charge a higher amount for the device to ensure the proper cash flow from the start and will price accessories cheaper to existing clients to continue making a profit.

Sustainability Report

To sustain the business of selling aerobic workout devices, an analysis can be made to the economic, social, and environmental impacts of the product. Firstly, the major economic impact on the company would be variable throughout the years since getting a viable customer base would prove to be somewhat difficult for a niche product. This leads to one of the negative impacts on the economy. After investing time, resources, and money, several marketing campaigns and promotions can be conducted to sustain the longevity of cash flow into the company. For the first year, an estimated projection can be made to show that the number of clients would be significantly lower than we desire. However, this ties into the concept of sustainability, by investing with this economic challenge, we can achieve a sustainable business model.

Secondly, a positive social impact can be derived from the economic investments listed above. Due to the specificity and uniqueness of our project's goal, many people who struggled with exercising may be able to make use of our design. This shows the societal value of our design and how it can provide a solution to people who don't have any options to turn to. This proves the sustainability of this business due to the positive societal impact the product can make. Alongside this, by creating positive relations with people in need of specific products, the general customer base of our business can expand by word of mouth and increase its reputation. This can help the business stand the test of time and continue to produce products for a stream of customers.

Economic Report

Costs

Table 1: Cost Classification

Value	Cost (3 years)	Cost Type	Direct/Indirect	Fixed/Variable
Material	$ 2 250 000	Material	Direct	Variable
Overhead	$ 60000	Expense	Indirect	Fixed
Manufacturing Equipment	$ 500 000	Expense	Direct	Fixed
Salary	$ 630 000	Labour	Direct	Fixed
Marketing	$ 75 000$	Expense	Indirect	Fixed

Rent	$ 72 000	Expense	Indirect	Fixed
Electricity	$ 150 000	Expense	Indirect	Fixed
Depreciation	$ 135 500	Expense	Indirect	Variable

3-year statement

Sales: $4 500 000 *(300$/unit assuming 2% of clients buy the product in year 1 with 50% increase in year 2 and 3 for a total of 4.5% of 326323 of our total client or approx. 15000 units)*
Cost of Goods: $2 250 000 *(Assuming approximately 150$/unit to manufacture)*
Gross Profit on Sales: $2 250 000
Operating Expenses:

Marketing Expense: $75 000
Salaries: $630 000
Overhead: $60 000
Rent: $72 000
Equipment: $500 000
Electricity: $150 000
Depreciation: $135 500

Total Operating Expenses: $1 622 500

Operating Income: $627 500
Income Tax (25%): $156 875
Net income: $470 625 *(over 3 years)*

NPV Analysis

NPV Analysis of Fixed Cost

During the next 3 years, the cost is expected to be as followed:

Marketing Expense: $75 000 ($25 000/year)
Salaries: $630 000 ($210 000/year)
Overhead: $60 000 ($20 000/year)
Rent: $72 000 ($24 000/year)
Equipment: $500 000 ($500 000 up front in year 1)
Electricity: $150 000 ($50 000/year)
Depreciation: $135 500 (10% yearly→year 1: $50 000→year 2: $45000→year 3: $40500)

$$NPV = \Sigma \frac{FV}{(1+i)^n}$$
$$NPV = 500\,000 + \frac{379\,000}{(1+0{,}1)} + \frac{374\,000}{(1+0.1)^2} + \frac{369\,500}{(1+0.1)^3}$$
$$NPV = 500\,000 + 344\,545.46 + 309\,090.91 + 277\,610.82$$

$NPV = 1\,431\,247.19\$$

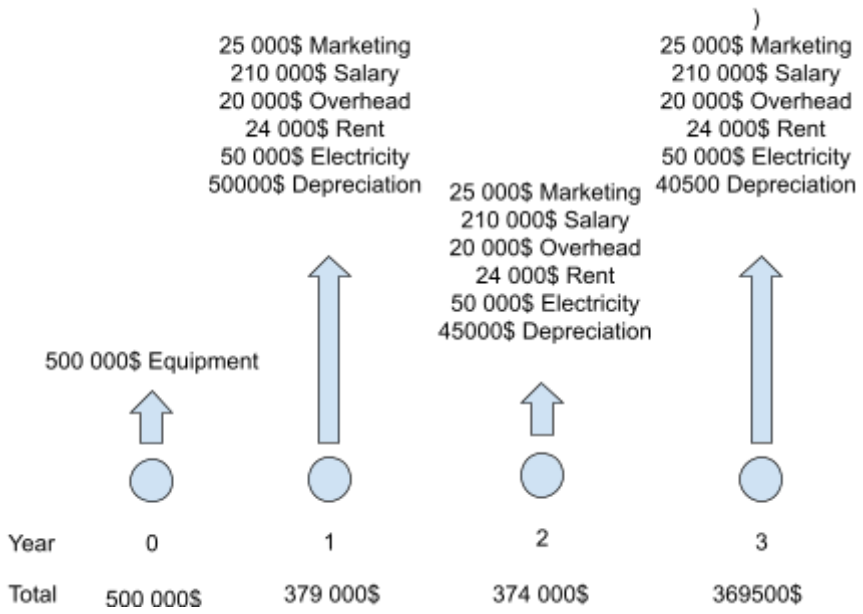

Figure 1: Yearly Cost

NPV Analysis of Income

During the next 3 years, the income is expected to be as followed:

Income: $4 500 000 (year 1: 6527 units sold→year 2: 3263 units sold→year 3: 5210 units sold at 300/unit)
Cost of goods: $2 250 000 (year 1: 6527 units sold→year 2: 3263 units sold→year 3: 5210 units made at 150/unit)

$$NPV = Income - Cost\ of\ goods$$
$$NPV = \Sigma\frac{FV}{(1+i)^n} - \Sigma\frac{FV}{(1+i)^n}$$
$$NPV = \left(\frac{1\,958\,100}{(1+0{,}1)} + \frac{978\,900}{(1+0.1)^2} + \frac{1\,563\,000}{(1+0.1)^3}\right) - \left(\frac{979\,050}{(1+0{,}1)} + \frac{489\,450}{(1+0.1)^2} + \frac{781\,500}{(1+0.1)^3}\right)$$
$$NPV = 1\,780\,090.91 + 809\,008.26 + 1\,174\,305.03 - 890045.46 - 404504.13 - 587152.52$$
$$NPV = 1\,881\,702\$$$

Break-Even Point

$$BEP = \frac{Fixed\ Cost}{Income - Cost\ of\ Goods} = \frac{1\,431\,247.19}{300-150} = 9541.65\ units \approx 9542\ units$$

By the end of year 2, we estimate having sold approximately 9790 units so we will be profitable shortly before the start of the second year

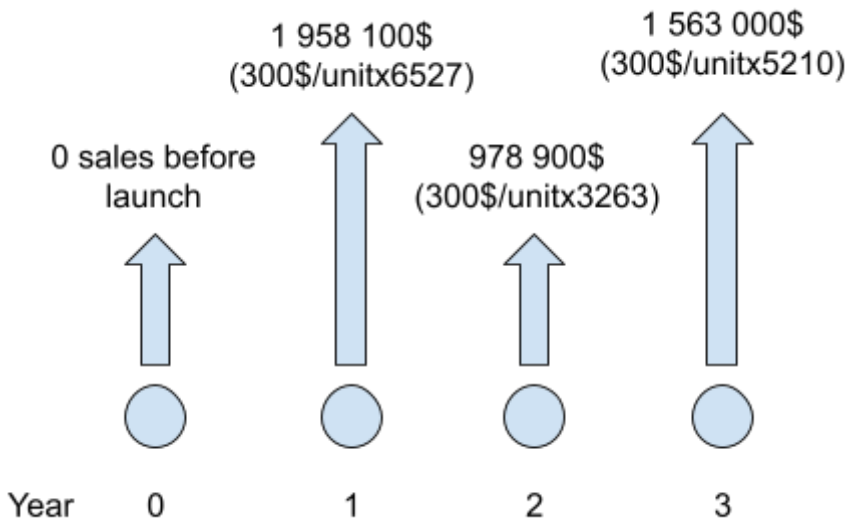

Figure 2: Yearly Cash Flow Income

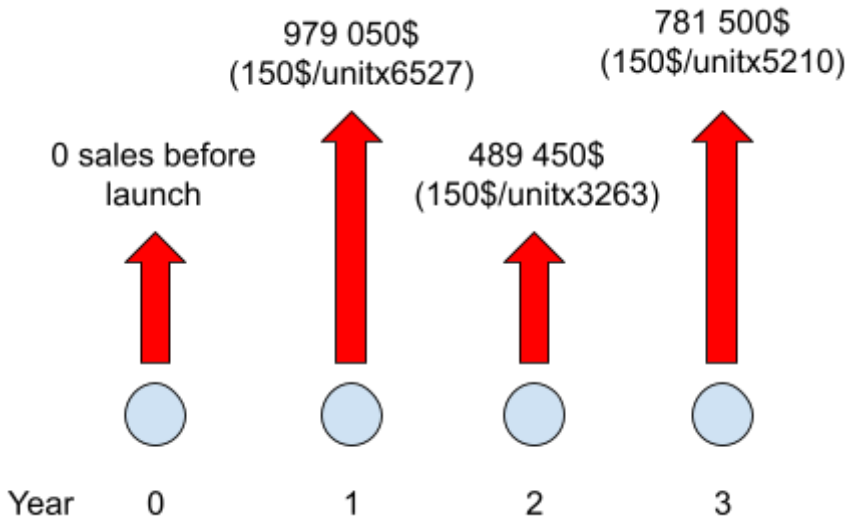

Figure 3: Yearly Cash Flow for Cost of Goods

Economic Assumptions

To complete this economic report, our team had to estimate quite a few numbers. Our first estimation was the number of clients that would buy our product. As previously stated, we determined we could have approximately 326323 separate clients. Since this product is pretty much the only device to accomplish this goal, we assume a very small portion of our clients will buy the product in year 1 since they will not yet see the benefit so we assumed 2% of our total possible clients will purchase the device for a total purchase order of 6527 in year 1. We allocated a budget of $75 000 to marketing which we assumed will help this business grow 50% each year for a total of 9790 and 14685 units sold by years 2 and 3 respectively. Rounding up our total sales to 15 000 for simplicity at 300$ per unit, we will have a gross income of $4 500 000. To estimate the 300$ per unit cost, we had to base this cost on our reverse razor blade model. Since our model is to charge a steeper price up front, we decided to mark up the product 100% of the prototype cost which was approximately

$150. If we were to mass-manufacture this product, we would need to purchase mills and lathes which account for the $500 000 in manufacturing costs but would bring our production cost down. We also assumed we would have 3 employees making $70 000/year for a total of $630 000 over 3 years. To estimate overhead, rent and electricity, we took values that were discussed in class as reasonable. To estimate depreciation, we assumed all our machinery would depreciate 10% each year. After 3 years, our machinery would be worth $364 500 for a total depreciation of $135 500. To conduct the NPV analysis, we assumed an annual inflation rate of 5%.

Intellectual Property Report

During our research into existing protected intellectual property, our device did not have numerous conflicts with any existing products. Most existing push-up/exercise devices' goals are more geared towards increasing resistance to make an exercise more difficult to increase the effects felt by the user's body. During our research, we were able to find that US Patent US9155934B2 and US7377888B2 may cause a slight conflict

Patent US9155934B2

Found below in figure 4 is a picture of the device patented under US9155934B2. This device is a device which employs elastic workout out bands to be attached to the handle to increase the resistance of a pushup as claimed in the patent " A method of doing pushups employing the resistive force of a stretchable elastic exercise band in accordance with this invention, said method including the steps of: (a) employing a pair of pushup devices, each device including a body section having a lower surface for engaging a support surface and an upper handle section attached to said body section for engagement by a person desiring to do pushups; each pushup device further including at least one retainer for engaging a cooperating connection member of a stretchable elastic exercise band [5]. " Our device employs the resistive force of a stretchable spring which includes a lower surface for support and an upper handle section attached to the device body so the person can engage in completing a pushup. A slight differentiation between our device and the patented device is the patented device has the goal of increasing the difficulty of pushups while the goal of our device is to decrease the difficulty of a pushup. While the construction of our device sounds similar on paper, the main method of altering the pushup is different (spring vs elastic band) in addition to the overall appearance of both devices being completely different should not cause us any issues with infringement on this patent.

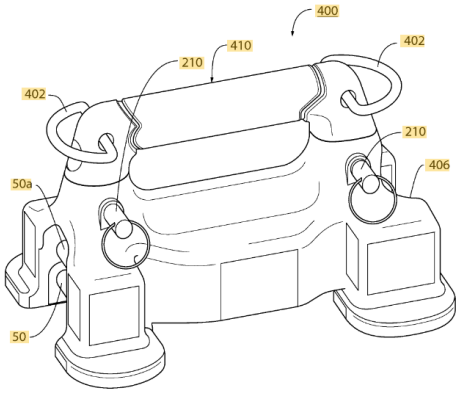

Figure 4: Patent US9155934B2 Push-up device [5]

Patent US7377888B2

Found below in figure 4 is a picture of the device patented under US7377888B2. This device is also a push-up exercise device with the goal of allowing the user to switch from the traditional push-up grip to a more comfortable stance to improve the user's comfort. The device's patent claims the following:

1. A device for performing pushups on a surface, comprising:

    a) a main handle having first and second ends, and a grip portion;

    b) a base having a bottom portion constructed to contact the surface, a top portion rotatably connected to said bottom portion, and a bearing assembly supporting said top portion on said bottom portion;

    c) a support connecting said main handle to said top portion and supporting said handle at an elevated position relative to said base and above the surface;

    d) a hand clutch that can be grasped and moved between first and second limit positions by squeezing with the user's fingers; and

    e) hand clutch bias means for resisting movement of said hand clutch from the first limit position to the second limit position. [6]

Again with this patent, the construction of the device is vaguely stated which leaves a lot of room for interpretation and while this may be similar, the bearing assembly included in the base and the clutch included in the patented device is enough to differentiate it from our device which should clear us of any breach of intellectual property on our end with this patent.

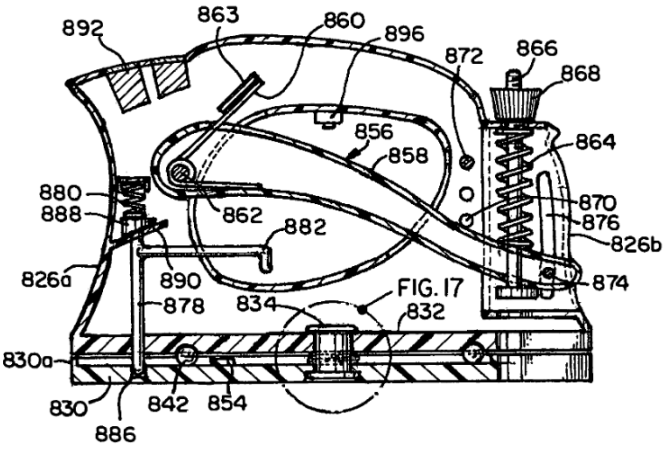

Figure 5: Patent US7377888B2 Push-up Device [6]

Project Plan

In this deliverable, our team updated our project plan for the following weeks by adding updated tasks and deadlines. The following link will take you to a snapshot of our current schedule.

Wrike Gantt Chart Link:
https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=0BfiP6y9vQCfk4asM3zAG8ZnDMHEWnaI%7CIE2DSNZVHA2DELSTGIYA

Conclusion

In conclusion, we believe this business is a sustainable business which follows the reverse razor blade model which would be able to turn a profit after selling 9542 units. In total, we foresee having potentially 326323 separate clients with us being able to sell to 2% of our total clients and assuming we grow at 50% every year. We will sell our product at 300$ and make 150$ per unit for a total net income of $470 625 over 3 years. Additionally, with the research and calculations provided in this document, our business plan is shown to be viable for continuous growth. After completing the intellectual property report, we reassured that patenting our product would be quite easy due to its unique design and purpose. Hardly any products seemed to be similar, clearing us of any intellectual property overlap.

Reference

[1]K. Lewandowski, “Hanger Clinic Blog | Limb Loss and Limb Difference: Facts, Statistics, & Resources,” *Hanger Clinic*, Apr. 01, 2022. https://hangerclinic.com/blog/prosthetics/limb-loss-and-limb-difference-facts-statistics-resources/#:~:text=With%20more%20than%202%20million

[2]“Americans engaged in sports and exercise per day US 2021,” *Statista*. https://www.statista.com/statistics/189562/daily-engagement-of-the-us-poppulation-in-sports-and-exercise/#:~:text=In%202021%2C%20it%20was%20found (accessed Mar. 09, 2023).

[3]“IBISWorld - Industry Market Research, Reports, and Statistics,” *www.ibisworld.com*. https://www.ibisworld.com/industry-statistics/number-of-businesses/gym-health-fitness-clubs-united-states/

[4]“IBISWorld - Industry Market Research, Reports, and Statistics,” *www.ibisworld.com*. https://www.ibisworld.com/industry-statistics/number-of-businesses/physical-therapists-united-states/

[5] B. Kassel, “Method of doing pushups and pushup device employed in said method.” https://patents.google.com/patent/US9155934B2/en?q=(spring+push+ups)&oq=spring+push+ups (accessed Mar. 16, 2023).

[6] T. R. Godbold, “Pushup exercise device.” https://patents.google.com/patent/US7377888B2/en?q=(~patent%2fUS9155934B2) (accessed Mar. 16, 2023).