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# Management Summary

  The problem our team faced was how to account for the financial impact of project delays in product development. Microtune had a product in the market and a new product was under consideration to replace the existing product. The goal was to determine the value of the new product to the firm. In order to generate a cost/benefits analysis for the implementation of a product we developed a series of models in Excel to account for various uncertainties.

A beta distribution was generated for the implementation process and we were able to generate a most likely scenario for the availability time of a new product. We noticed there would be financial advantages to selling a new product, but also realized that costs must be taken into account. A Monte Carlo simulation was used with 15,000 iterations to determine the most likely cost for the product implementation. Our team also developed a replacement function which we used to approximate the rate of cannibalization for product #2. The next step was to generate a sales data sheet to get a picture of the financial implications of the product cannibalization process. We were given a range of parameters which we displayed in three sales data scenarios: best case, mean result, and worst case. The sales datasheets allowed us to see revenue and profit for a ten year horizon.

 In the net present value calculation, the monthly profits were discounted at a rate we calculated in the financial portion of the model. We were able to generate a matrix containing nine possible income possibilities. We noticed that under good conditions the implementation can be highly profitable; however, if things go wrong then the company can lose money on the project. All of the scenarios are reliant on user definable parameters, but given accurate data the model can produce a comprehensive picture of the possible project outcomes.

# Company Background

Microtune, Inc designs and markets radio frequency, integrated circuits and subsystem module solutions for the worldwide broadband communications and transportation electronics markets. Microtune is committed to engineering innovation and excellence, designs and develops RF silicon and subsystems technologies that enable entertainment and communications in applications across todays most popular and ever-present consumer electronics products, such as: TVs, TV peripherals, set-top boxes, new digital converter boxes, computers, Internet and handheld devices and automobiles. A technology-brand and market leader, Microtune offers a broad family of multi-market products, including the patented MicroTuner™ TV tuners, silicon amplifiers and silicon solutions for cable infrastructure. They are targeted to worldwide customers developing solutions for the digital TV, cable TV, and automotive electronics markets. Even though Microtune is an American company, they get about 80% of their sales from outside the U.S. (5)

# Problem Background

The general problem is how to model and account for uncertainty that goes into all of the variables in a typical business plan.  A typical business plan attempts to forecast average selling prices, unit costs-of-goods, available market size, share of market and some level of operating expense to generate a net income forecast which can then be used to derive the net present value of the activity.  Any one of these variables is in turn dependent on other variables that are random to some extent - e.g. average selling price will depend on how much competing solutions cost, what, if any, components need to be added around our solution and how much they cost, and how much of a discount, if any, we need to offer to win business away from a competitor.  There is also a link to research and development in that the availability of all the products involved must be forecast, which in-turn depends on certain assumptions about when the product samples are first available, how long it will take for the first customer products to appear, how quickly the new product will be cannibalized by the next generation product, etc.[[1]](#footnote-2)

# Problem Description

 Microtune is in an industry where the technology changes rapidly and they have to stay on the cutting edge of innovation to stay one step ahead of their competition. Once Microtune puts out a new product A and gets their respective market share using an average selling price, they are concerned with volume, price, cost, revenue and profit. It costs Microtune $X to produce each unit. Average selling prices are eroding at a rate of X% per quarter, while unit costs are also eroding at a rate of X% per quarter. Revenue and profit are based on the cost and volume of the product sold.[[2]](#footnote-3)

Microtune has to start thinking about researching and developing a new product B to replace product A three to four years after it is released. This new product must be better than their original, better than the competition and hopefully is released before the competition releases their new product. When Microtune releases this new product, it must take over the current market share, and hopefully expand it, while keeping costs low and making more revenue as the original product cannibalizes throughout time. The new product B can be sold for X% over the price of product A when it is in the market, while unit costs are expected to be X% lower.[[3]](#footnote-4)

There are many pieces to the puzzle to piece together for a new product venture. The development time for the new product B is not set in stone because of unforeseen circumstances or problems. Microtune needs to take into consideration a delay until start time, which can occur for numerous reasons, through a best case (ts, max), worst case (ts, max), and most likely (ts, mode) case scenario. Then, once they start their new project, Microtune has to determine the duration of the project through a best case (td, max), worst case (td, max), and most likely (td, mode) case scenario. When they have finally completed their project and produced a new product, marketing provides Microtune with worst case, best case, and most likely estimates of how long product B will have until its first revenue following completion of development. Additionally, based on past history, marketing also has worst case, best case, and most likely estimates for when 50% and 80% of product A’s volume will be taken over by product B, which in turn also estimates revenue turnover for product B. We calculated this using a replacement function that produced two S-Curves: one representing the cannibalization of Product A and one representing the growth and takeover of Product B and they interested at some time t based on the case scenarios described above.[[4]](#footnote-5)

The likely case scenarios were used as a baseline for our model as the middle 50th percentile. We then determined Microtune’s different profit functions overtime based the various arbitrary scheduling uncertainties. We have provided a mean, 10th and 90th percentile estimates of Microtune’s project profit through three Beta distributions: two skewed toward the 10th and 90th percentiles and one even distribution representing the 50th percentile. In the Analysis section of this report we provide analysis of how the projected baseline profit is sensitive to changes in the project start date and the development duration for all three cases.[[5]](#footnote-6)

# Situational Analysis

As a group the approach to this problem seemed difficult. At first we thought of ways on how to just get it started. After many hours of deliberation and analyzing we came up with a simple beta and s-curve using Excel spreadsheets. Once we got started, the manipulating and analyzing of the data was our next big step. We chose Excel because we are working with a statistical model and felt this was the best way to demonstrate this. We could expand the model and make its complex components intertwine with relative ease using already coded in mathematical calculations within Excel. Since we created a business model, Microtune, as well as most businesses use Excel on a daily basis and it is cost effective for them and the users already know how to use Excel, so there is not a learning curve for a new program.

Even though Excel is relatively easy to use, we still encountered some problems with the logic and equations for our model. Originally we tried running it in one spreadsheet, but we quickly figured out that we needed multiple spreadsheets for each function we wanted to run (i.e. the Monte Carlo, Beta Distribution, Sales Data, etc.). For the Sales Data spreadsheets, we decided to split them into three different cases based on best, worst, and mean results for different data inputs.

# Model Description

Our team built a model using Excel spreadsheets to account for the numerous variables in the problem. The model consists of two products. The first product was currently for sale in the market and the second product was under consideration for development. In order to generate a cost/benefits analysis for the implementation of a product we developed a series of models to account for various uncertainties. A beta distribution was generated based off potential best and worst case scenarios for the three key activities we identified in the implementation process. The first activity we identified was project start decision time (Ts), which represents the initial meetings, and considerations a company goes through before giving the green light for product development. The second activity was project research and development time (Td), which is the time it takes to come up with a new product and test it. The third activity was project market readying time (Tr), which is the time associated with marketing the product and getting it through distribution chains, so it can be sold. From the beta distribution we were able to generate a most likely scenario for each of the activities.[[6]](#footnote-7) Our team defined this case as the mean scenario. We noticed that there would be financial advantages to selling a new product, but we also realized that the costs must be taken into account. We ran a Monte Carlo simulation using up to 15,000 iterations to determine the most likely cost for the three product implementation activities.

Our team also developed an S-Curve based on three diffusion parameters: level of awareness (P), contact rate (Q), and the fraction of informed individuals that purchase existing product (M). Level of awareness is the rate at which the market becomes aware of the new product. Contact rate is the opportunity that purchasers have to interact with the new product. And the fraction of informed individuals that purchase the existing product is a representation of the friction new products experience. It is common for purchasers to be hesitant to adopt a new product over an existing product that they are comfortable with, even when presented with advantages. From the three parameters we were able to approximate the rate of cannibalization for product #2 (7).

# Definition of Terms

* **Net Present Value (NPV):** is an indicator of how much value an investment or project adds to the firm (2).

Market Inputs To find existing company market size and there are five different inputs associated with it:

* **Current Total Market Size** is an arbitrary number that is determined by the current market activity.
* **Existing Company Market Share** is the current percentage of the market Microtune occupies.
* **Market Price** is the current price on the market for the Product 1.
* **Discount from market Price** is a discount given to clients who buy Microtune’s products in mass quantities.
* **Discount Market Size Increase Multiplier** is a factor change for every percent discount or premium from market price.
* **Existing Company Market Size** equal Current Total Market Size \* (Existing Company Market Share + (Discount from Market Price \* Discount Market Size Increase Multiplier)). This variable assumes that there is a steady and growing demand for products each month.

## **Pricing Data**

* **Product #1 Average Selling Price** is Market Price \* (1 – Discount from Market Price).
* **Product #2 Premium** is an input parameter provided by the user.
* **Product #1 Average Selling Price** is (Product #1 Average Selling Price)\* (1+ Product #2 Premium).
* **Product #1 Cost of Goods Sold** is Product #1 Average Selling Price\*0.477.

Financial Data These values are used to ascertain the financial impact of the project and the current state of the firm.

* **BETA** describes how the expected return of a stock or portfolio is correlated to the return of the financial market as a whole. Microtune’s current BETA is 1.74 (1).
* **Risk Premium**is the expected rate of return above the risk-free rate. When measuring risk, the common approach is to compare the risk-free return on 10-year T-bills and the return on other investments. The difference between these two returns can be interpreted as a measure of the value return for holding a risky asset. Microtune’s risk premium is 2.69%.
* **Risk Free Rate** is the 10-year T-bill rate of 3.21%
* **Discount Rate** is Risk Free + (BETA \* Risk Premium).
* **P/E** is the price-to-earnings ratio is a measure of the price paid for a share relative to the annual net income or profit earned by the firm per share (3). Microtune’s ratio is 63.33 (4).
* **Market Cap** represents the market value of a company. Microtune’s is currently 114,600,000, which is considered very large (4).
* **Shares Outstanding** is the number common shares that have been authorized, issued, and purchased by investors. Microtune currently has 52,090,000 outstanding (4).
* **Share Price** is the cost of 1 common stock. Microtune’s current stock price is $2.25 (4).
* **Net Income** is the Market Cap divided by the price-to-earnings ratio. Microtune’s is $180188.50 (4).

Rate Changes These values represent changing market conditions. We assume that the market grows at a steadily increasing rate and that ASP and COGS are subject to erosion.

* **Market Growth Rate** is the rate at which the market for a current product is growing – this is an arbitrary value.
* **Product #1 Average Selling Price Erosion** is the rate at which Product 1’s ASP is falling over time
* **Product #1 Cost of Goods Sold Erosion** is the rate at which Product 1’s COGS is falling over time
* **Product #2 Average Selling Price Erosion** is the rate at which Product 2’s ASP is falling over time
* **Product #2 Cost of Goods Sold Erosion** is the rate at which Product 2’s COGS is falling over time

## Product #2 Activity Times

* **Project Start Decision Time – Minimum** is the smallest month total possible to start the project
* **Project Start Decision Time – Maximum** is the greatest month total possible to start the project
* **Project Research and Development Time – Minimum** is the smallest number of months for project research and development.
* **Project Research and Development Time - Maximum** is the longest time project research and development could take.
* **Project Market Readying Time – Minimum**is the fewest amount of months to get a developed product into the market
* **Project Market Readying Time - Maximum** is the longest timeframe to get a developed product into the market.

## Product #2 Activity Costs

* **Project Start Decision Cost – Minimum** is the smallest cost it will take to get the project off the ground.
* **Project Start Decision Cost - Maximum** is the most money required to start the project.
* **Project Research and Development Cost – Minimum** is the minimum amount of money it will take to do all the research and development associated with the product.
* **Project Research and Development Cost - Maximum** is the most money possibly allocated for research and development.
* **Project Market Readying Cost – Minimum** is the smallest cost associated with bringing the product to the market
* **Project Market Readying Cost - Maximum** is the biggest cost to get the product market ready.

## Replacement Function Parameters:

* **Level of Advertising (P)** is an innovation rate (7).
* **Contact Rate for Purchasers (Q)** is the contact rate for non purchasers (7).
* **Fraction of Informed that Purchase Product (M)** is the fraction of those who become informed at any point in time and will proceed in purchasing the old product (7).

# Technical Description

The Input Control Sheet controls all the possible outcomes that could change the net present value of the project. The sheet is divided into a series of modules each with a number of elements:

## Summary Module

The first module includes three elements that summarize the overall value of the project to the company followed by a possibilities matrix outlining a number of scenarios. The matrix displays potential best, mean and worst case outcomes for the company and through using three macros and a data table each option can be placed in the gross net present value box. The gross net present value element represents the present value of a given scenario’s net incomes over a 10 year time horizon minus the implementation costs of coming up with a second product. The net present value element is the difference between the selected scenario in the gross net present value element and the present value of cash flows if the firm decided not to develop a new product. The impact to stock price is the net present value element divided by the number of shares outstanding. The three macros to shift between scenarios are (Ctrl + Shift + Q) for best case income, (Ctrl + Shift + W) for mean result income and (Ctrl + Shift + E) for worst case income. To shift between the varying cost estimates in the gross present value element select the tab to the right of the element and pick the cost level. The three levels are clearly outlined in the scenario matrix. Also remember to reset the Monte Carlo simulation macro when any change is made by pressing (Ctrl + Shift + R).

## Market Inputs Module

The second module determines the market size for the products. Items that can be user modified are highlighted in yellow. The user should enter an estimate for the market size and estimated market shares for the existing product and the new product. Ideally the goal will be to capture a larger market share with the second product. Additionally, the user should enter a value for the going market price for the product and any level of discount the firm will offer to draw purchasers to their product. The final option is to edit the factor by which discounts offered by the firm increase the firm’s market share. The default value is 2, which means that for every percentage decrease in price the firm will gain twice that percentage in market share.

## Pricing Data Module

The pricing data module is mostly derived from the market inputs. However, the user does have the option of setting the premium for product #2, which represents the percentage increase between the starting price of product #1 and product #2.

## Financial Data Module

This module revolves primarily around the “Financials” macro. This macro updates a number of the financial measures used in analyzing the value of the company and the project by accessing Google finance. Google finance produces values for BETA, P/E ratio, market capitalization and shares outstanding. These values are customizable by the user, but the most up-to-date information comes from the internet. The value for beta is factored into the discount rate calculation, which is used to discount the future net income generated by the product to the present. The other two factors that go into the discount rate calculation are the risk free rate and the risk premium. The risk free rate we used is the 10-year T-bill rate which is easily looked-up on the internet and the risk premium is the expected return for the company minus the risk free rate. Also, P/E ratio, market cap and shares outstanding are used to determine the company’s net income and share price.

## Rate Change Module

The rate changes are all user customizable. Our model assumes that the market size is continuously growing and that average selling price and cost of goods sold are both eroding over time for both products. The user has the opportunity to change all of these inputs to analyze the financial effects of each change.

## Project #2 Activity Times Module

This module provides the time ranges for the three different activities that make up the product implementation. The different inputs get factored into a beta distribution which produces a mean result for the time until project #2 will start generating revenue.

## Project #2 Activity Cost Module

This module provides the potential maximum and minimum cost for the three different activities that make up the product implementation. The different inputs are used to run a Monte Carlo simulation which provides a mean total implementation cost for product #2. To reset the value of the simulation use the macro (Ctrl + Shift + R).

## Replacement Function Module

The replacement function generates an S-curve that estimates the proportion of the market that each product captures. This is essential the cannibalization portion of the model. Over time product #2 will capture more of the market share and product #1 will find itself phased out. We have assumed complete cannibalization will occur the rate at which it occurs is user-definable. There are three elements that shape the curve. The elements are level of awareness, contact rate and the fraction of people informed about the new product that will still purchase the old. The first parameter speeds up cannibalization, while the second and third slow it down (7).

## Parameter Data Sheet

Activity Time Distribution Parameters includes Project Start Decision Time (Ts), Project Research and Development Time (Td), and Project Market Readying Time (Tr) and gives the Best, Mean, and Worst case scenarios for each of those parameters. The numbers associated with each them are referred back to the Financial Data sheet as defined above. The Beta Distribution Shaping Parameters include Alpha and Beta that are incorporated as our upper and lower parameters in our Activity Time Beta Distribution spreadsheet. The Total Time Until Product #2 is Market Ready includes the Best, Mean, and Worst case scenarios. These numbers are found by adding the Project Start Decision Time (Ts), Project Research and Development Time (Td), and Project Market Readying Time (Tr) together for their respective case (1).

Activity Cost Distribution Parameters includes Project Start Decision Cost, Project Research and Development Cost, and Project Market Readying Cost and gives the Best, Mean, and Worst case scenarios for each of those parameters. The Best and Worst case scenarios are referred back to the Financial Data sheet as defined above, but the Mean case scenario is referred to the Activity Cost Monte Carlo data sheet, which calculates a mean through 15,000 iterations. Total Cost To Get Product #2 Market Ready is the sum of best, mean, and worst case scenarios for Project Start Decision Cost, Project Research and Development Cost, and Project Market Readying Cost, respectively (6).

Sales Data Parameters refers to the Company Market Size and Market Growth Rate, both of which get their values from the Financial Data sheet. Product 1 and 2’s current ASP and ASP Erosion are listed here along with their Current COGS and COGS Erosion rate, all of which refer back to the Financial Data Sheet as defined above.

## Sales Data Sheets

There are three spreadsheets representing the sales data: Sales Data – Best Case, Mean Case, and Worst Case. The variables used in the Sales Data spreadsheet are Time (T), Volume, Price, Cost, Revenue, and Profit for Product’s 1 and 2. Volume, Price and Cost are based off of arbitrary values that can be changed using the Sales Data Input sheet. Time for Product 1 started at 0 months and went up by *n* + 1 month and we assumed that it was already in the market with a market volume of 10,800 at T = 0. Volume for Product 1 continues to grow until Product 2 is introduced to the market, which is based on the project start time, research and development time, and the project market ready time, and this will begin the cannibalization of Product 1 at an erosion rate. This is defined using the If Statement:

*IF(T for Product 1 < T for Product 2, (If True) Market Size \* T+1 ^ Market Growth Rate, (If False) Market Size \* (T+1) ^ Market Growth Rate \* Time Shifted Inverse Function)*

**Price** is based on an average selling price that is determined by the market price and multiplied by a discount from the market price (arbitrary percentage) for their clients. This is also based on covering fixed costs and the demand for the product. Price is then calculated throughout time by the arbitrary price times the time period to the power of erosion, also an arbitrary variable. The equation for price is as follows:

*ASP = Market Price \* (1 – Discount from Market Price)*

*Price = ASP \* (T+1) ^ (ASP Erosion Rate)*

**Cost** per unit is a random number that will be determined by Microtune and can be plugged into the Financial Data sheet as well, which changes data throughout the whole Excel file. The initial cost of goods sold is calculated by the average selling price times 0.477. Throughout time, that calculated price is then multiplied by t + 1 raised to the power of a cost of goods sold erosion rate that is also a random variable.

*Cost of Goods Sold = (ASP \* 0.447)*

*Cost = COGS \* (T + 1) ^ (COGS Erosion Rate)*

**Revenue** is calculated by multiplying price and cost together throughout all of the time periods.

**Profit** is calculated by the market volume times price minus cost. We use the same calculations for all three spreadsheets the difference is when Product 2 is introduced to the market place. The start time for Product 2 is determined by the sum of the project start time, research and development time, and the project market ready time for the best, mean, and worst case data sales sheets, respectively. The volume starts at zero and is multiplied by the old market share times the current time period minus one times the quantity of the erosion rate (same as product 1) times a function similar to the Sigmoid function to produce the S-Curve.

## Replacement Function Sheet

Adoption of the product is an important part of analyzing the demand model. Looking at a single product at a time, we used (M) as the adoption rate, which is the fraction of those who become informed at any point in time and will proceed in purchasing the original product. (P) and (Q) are innovation rates. (P) represents the constant level of advertising. (Q) is the contact rate for purchasers and the contact rate for non purchasers are assumed to be 0 (7).

The S curve is the derivative of the information function.

$$\frac{dI\left(t;T\right)}{dt}=\left[1-I\left(t;T\right)\right]\left[p+qX\left(t\right)\right]$$

We multiplied ours by six because we wanted our model to resemble months. Six worked out to be a good multiplier to get the results we wanted. X(t) is the fraction of the population that has purchased the product by time t. This will show us the rate at which the product is being purchased (7).

$$X\left(t\right)=mI\left(t;T\right)$$

All of these equations above form linked Riccati equations for the information function.

$I\left(t;T\right)=\frac{δ\left(1-e^{-6µt}\right)}{\begin{array}{c}\left(δ+e^{-6μt}\right)\end{array}}$ with $δ=\frac{p}{qm}$ and *µ* = *p* + *qm*

To calculate all of our data in months we were forced to change the dynamics of the equation by multiplying the exponentials power by six. $δ$ equals the constant level of advertising (P) divided by the contact rate for purchasers (Q) and the adoption rate (M). *µ* is the constant level of advertising (P) plus the contact rate for purchasers (Q) multiplied by the adoption rate (M) (7).

 The Inverse Information Function is equal to 1 – Information Function:

$$1-I\left(t;T\right)$$

## Activity Cost Monte Carlo Sheet

For the total expected cost of the activity we used a simulation similar to the Monte Carlo. The total cost of the project variable is simulated by generating a random value between a minimum and maximum value entered by the user. This variable will be normally distributed because it is a sum of numerous random variables (6).

 Our model generates random values for each of the activity costs. The best case cost is the minimum values entered by the user added up. The worst case cost is the maximum values added up. The mean case cost is all of the random values averaged.

 To develop random variables we used the *RANDBETWEEN()* function. This gave us values in between the set values entered by the user. To determine the number of iterations to come up with a relatively decent value we first needed to evaluate the standard deviation between the maximum and minimum average values of the random variable.

*σ = STPDEVP(AVERAGE())*

We also looked at an error of less than two percent: This was the average of the maximum and minimum divided by 50. The number of iterations is determined by:

$$ε=\frac{AVERAGE()}{50}$$

The number of iterations is calculated by three time the standard deviation divided by the error of less than two percent squared.

$N=(\frac{3σ }{ε}$)2

We also solved for the true error which was done by doing these same steps just through our whole sheet of data. The kurtosis and skewness were not used in our assessment of the project but we found them pretty interesting in our work. The Kurtosis is a relative measure of the shape compared with the shape of the normal distribution. The normal distribution has a kurtosis of zero. The skewness is the measure of asymmetry. The normal distribution of skewness is zero as well (6).

# Analysis

 Our model represents a good starting point for project consideration. We have outlined our assumptions, and the formulas used in our evaluation are easily accessible. The model provides a comprehensive view of the effects of changing product implementation cost and time parameters and can be used to gauge riskiness by altering exogenous variables the company cannot control.

 The goal of the model was not to come up with a definitive answer. Instead, it was to come up with a method for achieving an answer given a set scenario. Looking at the model numbers as they stand now only provides a small picture of what the tool is capable of. We have input simple estimates to illustrate how the model works, but the true value of the model lies in its flexibility. The user has the capability to modify cannibalization rate and market conditions, which can be used for future projections or current product evaluations.

We used a number of statistical tools to articulate potential market conditions. A beta distribution was used for development times. The distribution is representative of typical development times and the end points can be adjusted for worst and best case scenarios. For cost, we used a Monte Carlo; the simulation can be run with up to 15000 iterations, which should provide an accurate value for the mean cost of the implementation process. Our projected cannibalization is represented by an S-curve referred to as replacement function. It is easily modifiable, but the current parameters provide a reasonable timeframe for product cannibalization. Partial cannibalization models we considered, but we lacked the requisite information to add the feature. Admittedly, the model doesn’t account for everything, but it is expandable should the need arise.

 The coding and layout of the model provide a good backbone to add more complexity. If a company decides that new factors need to be integrated into the projections the model can easily be fitted with new conditions and continue to function. The least flexible portion of the model is the macros, which will have to be edited when any changes are made to the model. Unfortunately, macros play a critical role in the scenario management and data update portions of the model. Without them the user would be required to manually input parameters. This would hinder the user and waste time. However, this is a minor concern. In general the concerns in the model are far outweighed by the utility. Our model provides a re-useable and comprehensive means for evaluation project cost, which allows Microtune to make accurate budgeting decisions.

# Conclusion

 The goal of the final business model is to help Microtune make good decisions based upon the numbers the company decides to use. The model provides the best, mean and worst case scenarios for net present value (NPV). If the parameters are input correctly and the assumptions accounted for, then Microtune should make the decision to implement the new product if the selected scenario NPV is greater than zero. A positive NPV would mean that Microtune’s investment in a new product would add value to the company. If the NPV is less than zero, then the investment into the new product would subtract value from Microtune and the project should be rejected. Another option is to re-calculate the parameters to attempt to increase the value of the project or decrease the costs. If the NPV is equal to zero, the investment would not gain or lose value for the company, and the company would be indifferent unless the new product could provide new external opportunities for benefit. If multiple positive options are available, then the project with the highest NPV should be selected.

Evaluating business decisions using our model often isn’t definitive. It is possible that of the nine scenarios outlined in our model some will provide a positive NPV, while others will not. It is up to the discretion of the company whether to proceed. However, the company risk would increase substantially with each scenario that produces a negative NPV. The output matrix in the input control sheet is literally a picture of what the project could produce financially. Through simple manipulation the user can swap through project conditions. It is up to the user to act and company risk tolerance will play a role in the acceptance of a project unless all nine scenarios are positive. Our model provides a tool for evaluation; the ultimate decision is in the hands of the user.

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# Appendices

## Beta Distribution:

## Product #1 – Price & Cost – Best Case:

## Product #1 – Price & Cost – Mean Result:

## Product #1 – Price & Cost – Worst Case:

## Product #1 – Revenue & Profit – Best Case:

## Product #1 – Revenue & Profit – Mean Result:

## Product #1 – Revenue & Profit – Worst Case:

## Product #2 – Price & Cost – Best Case:

## Product #2 – Price & Cost – Mean Result:

## Product #2 – Price & Cost – Worst Case:

## Product #2 – Revenue & Profit – Best Case:

## Product #2 – Revenue & Profit – Mean Result:

## Product #2 – Revenue & Profit – Worst Case:

## Products 1 & 2 - Revenue & Profit - Best Case

## Products 1 & 2 - Revenue & Profit - Mean Results

## Products 1 & 2 - Revenue & Profit - Worst Case



















1. Appendix p. 36 [↑](#footnote-ref-2)
2. Appendix p. 33 [↑](#footnote-ref-3)
3. Appendix p. 33 [↑](#footnote-ref-4)
4. Appendix p. 34 [↑](#footnote-ref-5)
5. Appendix p. 35 [↑](#footnote-ref-6)
6. Appendix p. 37 [↑](#footnote-ref-7)