

MOT I

ModiFi

Fall 2018

Group 22

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December 6th, 2018

Table of Contents

Section 0

- 0.1 Executive Summary
- 0.2 Cross-Referenced Description

Section 1 Project Phase I

- 1.1 Vision, mission, business/development goals
- 1.2 Technology/product/market/competitive strategies
- 1.3 Functional map of new technologies and products
- 1.4 Competitive analysis
- 1.5 Market sizing (revenue map) and market (customer) needs analysis
- 1.6 Aggregate Project Plan
- 1.7 Preliminary risk analysis (Decision Trees/Decision Analysis)

Section 2 Project Phase II

- 2.1 Project planning: Activities Matrix, GANTT, Pert, CPM for Phase 2 and Phase 3
- 2.2 House of Quality
- 2.3 Reverse Engineering
- 2.4 Conceptual Design
- 2.5 Phase II Report

Section 3 Project Phase II

- 3.1 Prototyping Strategy
- 3.2 Product Platform/Line Strategy
- 3.3 Failure Modes and Effect Analysis(FMEA)
- 3.4 Economic/Financial Modeling
- 3.5 Product Release Map

Section 0

0.1 Executive Summary for ModiFi

The Market

Across the United States and among many government sectors there is an explosion of need for laptops. Many government sectors have a need for laptops. Additionally, due to security clearances it can take contractors and employees up to 4 months to gain approval for simple peripherals such as a mouse. Our market research indicated that 8 out of 10 government contractors and government agency employees would desire modularity within their already restricted pool of choices.

Our Competitive Advantage

While there are some functional prototypes of modular laptops in existence, only ModiFi is the first to offer a market aimed at the government and education sectors. Project Christine from Razer offered a glimpse of a modular desktop, and Project Arya of Google provided future technology inspirations expressed through a modular phone. However, neither has been released to the market and the concept has remained an aspiration until now. ModiFi will remain the first in the market to offer customers the possibilities of this technology, and with continued development, this will continue to be its competitive advantage.

Financial Projections

Based on the size of the market and our defined market area, our sales projections for the first year are 80,000 units with each unit priced at 1,500 US dollars, which is a common mid-entry laptop price. We are expecting to make 117.2 million US dollars in profit.

0.2 Cross-Referenced Description

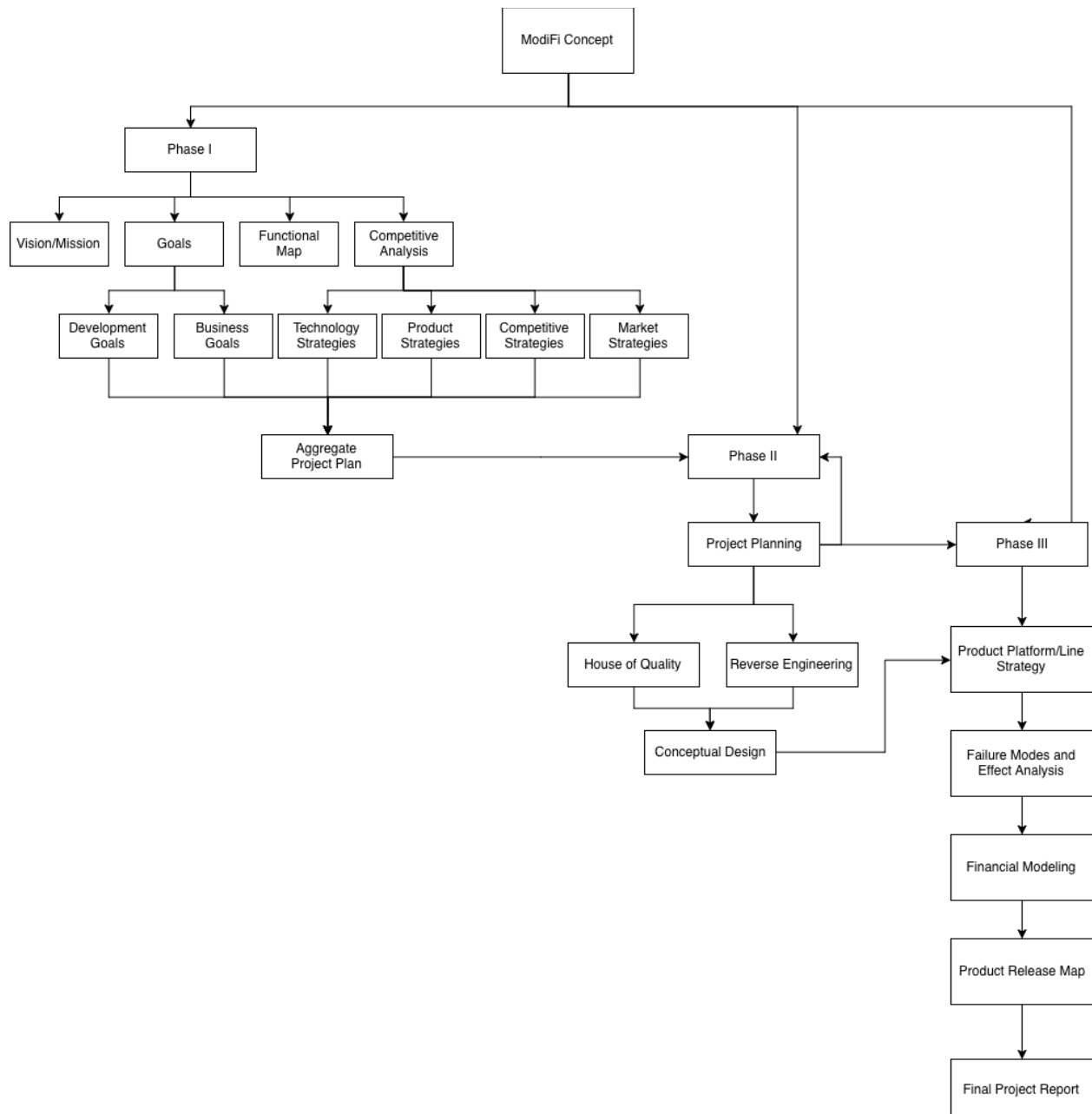
Each section is broken up into phases, beginning with the project proposal describing how and what we do as ModiFi. We briefly described our product idea that our product development team plans to make within the next 3 months. Following this, our proposal is broken up into 3 main sections. The first being Management, second being Development, and the third being Commercialization. All of the main sections encompass each other and include parts of the other sections. This layout serves as a top down approach to our project.

The first section under Management follows phase 1. As seen above, phase 1 encompasses the history of the company and our vision and mission statements which can also be seen in our executive summary. Phase 1 also incorporates our product's technology, market, and competitive strategy alongside a functional map of new technologies followed by a competitive analysis, market sizing, and aggregate project plan.

The second section under Development is called Phase 2. As seen after Phase 1, Phase 2 encompasses the project planning. Our project planning has an Activities matrix, a GANTT chart, a PERT chart, and a Critical Path. Following that there is a House of Quality technique used to further refine our product. Then, there is a reverse engineering section that is a conceptual design followed by a report.

The third section under Commercialization is called Phase 3. Phase 3 after phase 2 focuses on Commercialization. It follows Modifi's Prototyping strategy followed by

Failure Modes and Effects Analysis (FMEA). The economic/financial modeling and our product release map comes after.



Project Phase I

Section 1.1 Vision, Mission, Business/Development Goals

Vision

To create a world where laptops are completely modular so performance will not be affected by the passage of time.

About ModiFi

ModiFi began as a start up with the vision of becoming the first company to mass produce modular laptops. Tired of laptops being upgraded every 3-4 years, ModiFi began designing laptop chassis that feature modular motherboards. ModiFi inc. acquired ModiFi as of early 2015 and ModiFi is now a subsidiary of ModiFi Inc.

Mission

Using ModiFi, customers can change and upgrade any component of their laptop. The ModiFi laptop should be modular by switching out any of its hardware, and push in new hardware component, like LEGO. Laptop of ModiFi will have better performance and lower price.

Business Goals(ROI, market share, Revenue and Growth Aspiration)

ModiFi 's ROI from 2009 to 2013

DELL Annual Return On Investment	(FY 2013)	(FY 2012)	(FY 2011)	(FY 2010)	(FY 2009)
	(Jan. 31, 2013)	(Jan. 31, 2012)	(Jan. 31, 2011)	(Jan. 31, 2010)	(Jan. 31, 2009)
Y / Y Investment Growth	6.96 %	17.87 %	30.11 %	26.21 %	28.84 %
Y / Y Net Income Growth	-32.07 %	32.52 %	83.88 %	-42.17 %	-15.91 %
Annual Return On Investment	9.84 %	15.5 %	13.78 %	9.75 %	21.29 %

Dell ROI - Return on Investment Historical Data

Date	TTM Net Income	LT Investments & Debt	Return on Investment
2018-07-31	\$-1.56B	\$55.63B	-2.61%
2018-04-30	\$-2.21B	\$61.75B	-3.66%
2018-01-31	\$-3.33B	\$61.48B	-5.49%
2017-10-31	\$-4.14B	\$60.64B	-6.80%
2017-07-31	\$-5.12B	\$58.31B	-8.19%
2017-04-30	\$-4.39B	\$62.34B	-7.71%
2017-01-31	\$-3.25B	\$62.07B	-7.33%
2016-10-31	\$-1.59B	\$67.10B	-4.99%
2016-07-31	\$-0.16B	\$36.03B	-1.04%
2016-04-30	\$-0.33B	\$12.25B	-5.37%
2016-01-31	\$-0.52B	\$12.12B	-17.27%
2015-10-31	\$-0.52B	\$0.00B	-14.60%
2015-07-31	\$-0.44B	\$0.00B	-12.39%

ModiFi 's Market Share

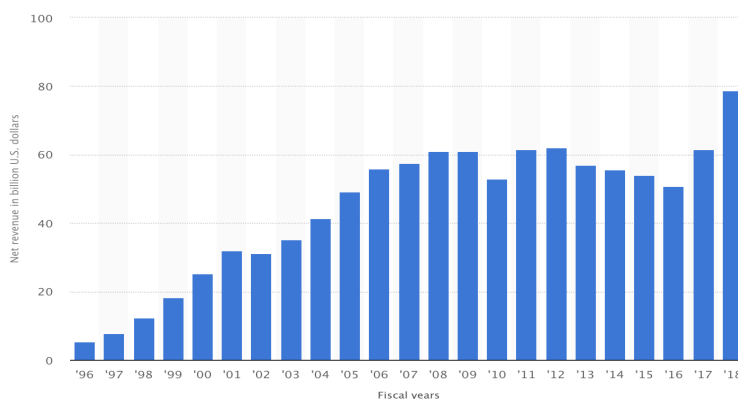
Table 1

Preliminary Worldwide PC Vendor Unit Shipment Estimates for 4Q17 (Thousands of Units)

Company	4Q17 Shipments	4Q17 Market Share (%)	4Q16 Shipments	4Q16 Market Share (%)	4Q17-4Q16 Growth (%)
HP Inc.	16,076	22.5	15,084	20.7	6.6
Lenovo	15,742	22.0	15,857	21.7	-0.7
Dell	10,841	15.2	10,767	14.7	0.7
Apple	5,449	7.6	5,374	7.4	1.4
Asus	4,731	6.6	5,336	7.3	-11.3
Acer Group	4,726	6.6	4,998	6.8	-5.4
Others	13,990	19.6	15,599	21.4	-10.3
Total	71,556	100.0	73,015	100.0	-2.0

Notes: Data includes desk-based PCs, notebook PCs and ultramobile premiums (such as Microsoft Surface), but not Chromebooks or iPads. All data is estimated based on a preliminary study. Final estimates will be subject to change. The statistics are based on shipments selling into channels.

ModiFi annual revenue



For the business goals, we want ModiFi to bring ModiFi more revenue and market share in the laptop market, since no one in the laptop market has ever done modular laptop before. Our product will be an entirely new concept of the laptop.

Developmental Goals

- ***Technology***
 - Digitize content/hardware as much as possible (cloud computing, VMware, etc).
- ***Market***
 - Collaborate with or acquire competitors.
 - Indirect selling through retailers
 - PC market shift from desktop to portable computers caused ModiFi to consider indirect selling
 - Customers were able to get a feel of the laptops at the retailers
 - ModiFi seeks for locations that are closest to important regional markets to gain better market access
 - Sell products at an optimal cost by decreasing inventory cost and delivery time
 - Have the right amount of inventory so that it satisfies the supply and demand without affecting the level of service
 - Having sufficient amount of sales data and market trends to predict the demand
 - Therefore an abundance of products in inventory would not be a problem
- ***Development***
 - Sustainability: divert 90% of waste generated from landfills and reduce product energy demand by 80%.
- ***Business***
 - Position themselves as the world's biggest infrastructure company in the pursuit of cloud-based technology.
 - Build factories around the world and look for location that provides advantages such as low labor cost and productive workforce

Section 1.2 Technology/product/market/competitive strategies

- ***Technology Strategy***
 - ModiFi focuses on developing technologies around data and AI.²
 - To dominate the market and data---the making, gathering, transporting, connecting, viewing, storing, and analysis of it.
 - The aim is to be hardware and VM-centric.⁶

- They have the resources to supply clouds with hardware, help customers develop cloud-native applications, and wrangle clouds with VMware.^{7,8}
- ***Product/market Strategy***
 - ModiFi products are targeted towards tech savvy people and working people.⁴
 - It has a large amount of manufacturing units and sales offices around the world (China, Ireland, India, etc.)
 - This allows ModiFi to have a competitive advantage in customer service.
 - Instead of choosing to eliminate or go against their rivals, ModiFi chooses to collaborate/form partnerships with them to rid of competition.
Ex:
 - Xerox - Supplied ModiFi with printing technology that they could offer to their customers
 - Juniper Networks - offered optimum network solutions under Power Connect Brand.
 - They sell more than just laptops and computers
 - Projectors, printers, supercomputers, etc. Allows for a broader range of consumers.
 - Pricing Strategies
 - ModiFi utilizes the low cost pricing strategy that other competitors are unable to do, giving them a competitive edge in the market.
 - Maintaining close relationships with suppliers
 - Suppliers have access to real time information on demand and expected volume for certain products.
- ***Competitive Strategy***
 - To create high quality, reliable products and deliver excellent customer service and satisfaction, in addition to becoming the cost leader around the world.
- ***Developmental Goals***
 - ***Technology***
 - Digitize content/hardware as much as possible (cloud computing, VMware, etc).
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Section 1.3 Functional map of new technologies and products

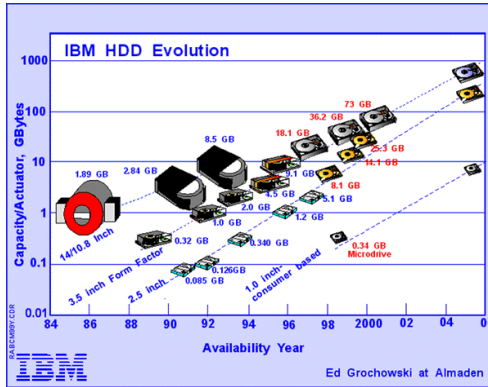
Technologies and Products related to Modular Laptops

(found in desktops)

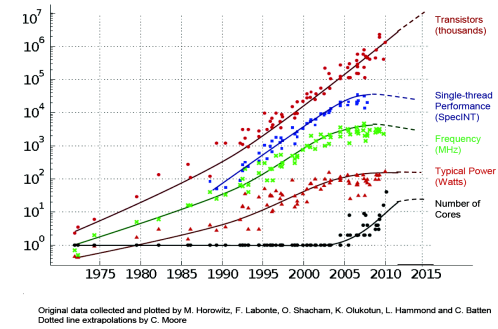
Any of these can be replaced on a desktop

- Power supply units: laptops come as an external power source known as a “power brick”
 - Modules: (for desktop) A detachable cable system which allows users to remove unused and unnecessary cables. This reduces the clutter which helps with the airflow within the power supply.
- Processors: a small chip found in laptops/desktops that is responsible for running the operating systems and applications used.
 - Module: Can be removed and replaced with a faster and newer processor.
- Mainboards: a circuit board that is responsible for the connection of the processor and many other components of a computer.
 - Module: There is no actual product, but there has been talk of one where it can be split into 7 piece and you can remove one part that is unneeded and replace it with a better one. For example, you could purchase a new RAM that supports DDR4 and swap out the old DDR3.
- Graphics cards: circuit board that is in charge of output displayed on the screen of the computer.
 - Module: For desktops, graphic cards can be switched out for a newer model resulting in a better output shown on the display screen
- Hard drives: data storage device that can store and retrieve information that from rotating disks covered in magnetic material.
 - Module: “Winchester technology”: removable disk drive, was soon changed to be permanent. There are hard drives that can be plugged into the computer and later removed.

- Optical drives: Disk drive that uses lasers and electromagnetic lights to read disks (ex: CD & DVD Players)
 - Module: Disk drives have been removed from laptops to get rid of weight and are instead a whole separate device which can be plugged in to the USB ports and used.



35 YEARS OF MICROPROCESSOR TREND DATA

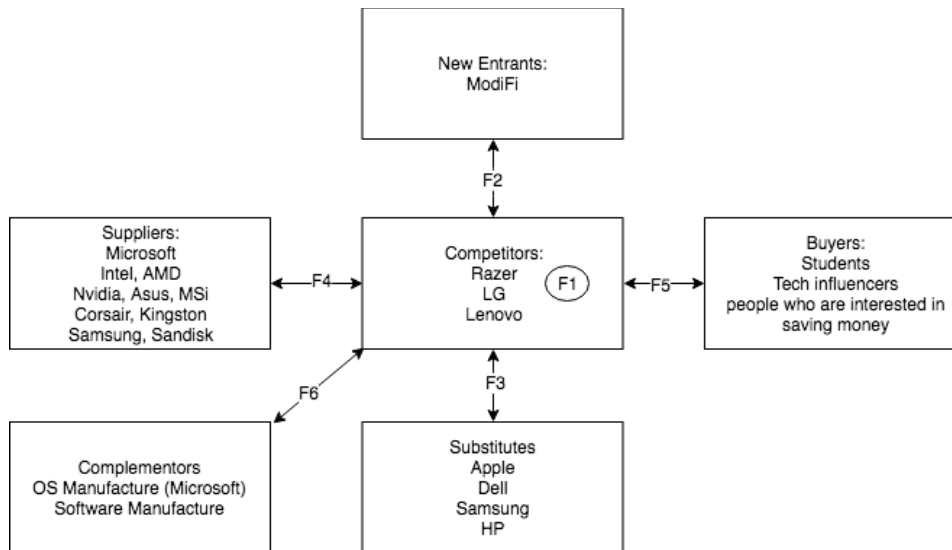


Section 1.4 Competitive analysis

Industry Analysis

Because ModiFi is a billion-dollar-plus company, one would assume that ModiFi is an active competitor in the computer/laptop business industry. Below is the Porter five(six) forces model which depicts competition and overall attractiveness of the market.

Porter five(six) forces model



Threat of New Entrants (Low)

The threat of new entrants in the PC industry is low. This is because there are major barriers to entry in this business. Apart from tremendous capital investment, the need for technological infrastructure and skilled employees strongly discourage any new entrants.

Threat of Buyers (Low)

The buyers' power is low to moderate due to the already established brand image. The consumers are either individuals or large enterprises. Customer loyalty is high because customers buy from name brands and ModiFi has focused on excellent customer service. These factors reduce the power of buyers.

Threat of Suppliers (Low)

Supplier power is low. This is because the industry is populated with suppliers where the number of established PC brands they already sell is small. Thus, companies that have established brands have leverage on suppliers making supplier power low.

Threat of Substitutes (Moderate)

The PC industry has been on the decline. Large established brands such as Apple and ModiFi have lost market share and profits. Till some years ago laptops were tools of professionals. Now there are better options that provide similar features like tablets and smartphones, so the threat of substitutes are moderate.

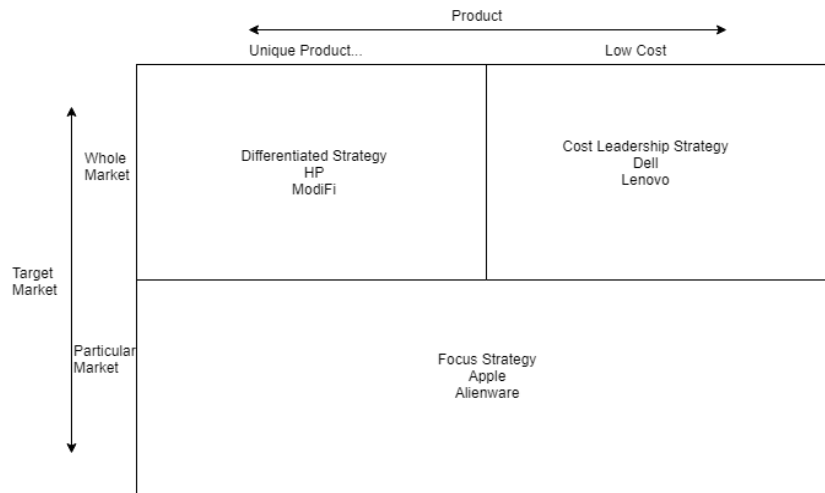
Threat of Rivalries (High)

Rivalry in the PC industry is high. Companies such as Acer, Asus, HP, and Lenovo are notable rivals. HP and Lenovo are at the top with the highest market share followed by ModiFi and Apple. Due to the decline in the computer industry the focus has shifted to price and innovation.

Threat of Complementors (High)

Due to having strong rivalries with companies such as Acer, HP, and Lenovo, complementors to the PC industry are relatively high. There are countless goods and services that complement the PC industry.

Company Position in the Laptop Industry



Competitive Strategy

ModiFi's competitive strategy is mostly centered around product differentiation and maintaining their competitive advantage. Historically, this competitive advantage comes from a direct-to-consumer model, as well as ModiFi's superior supply chain. There are four primary elements in ModiFi's competitive strategy:

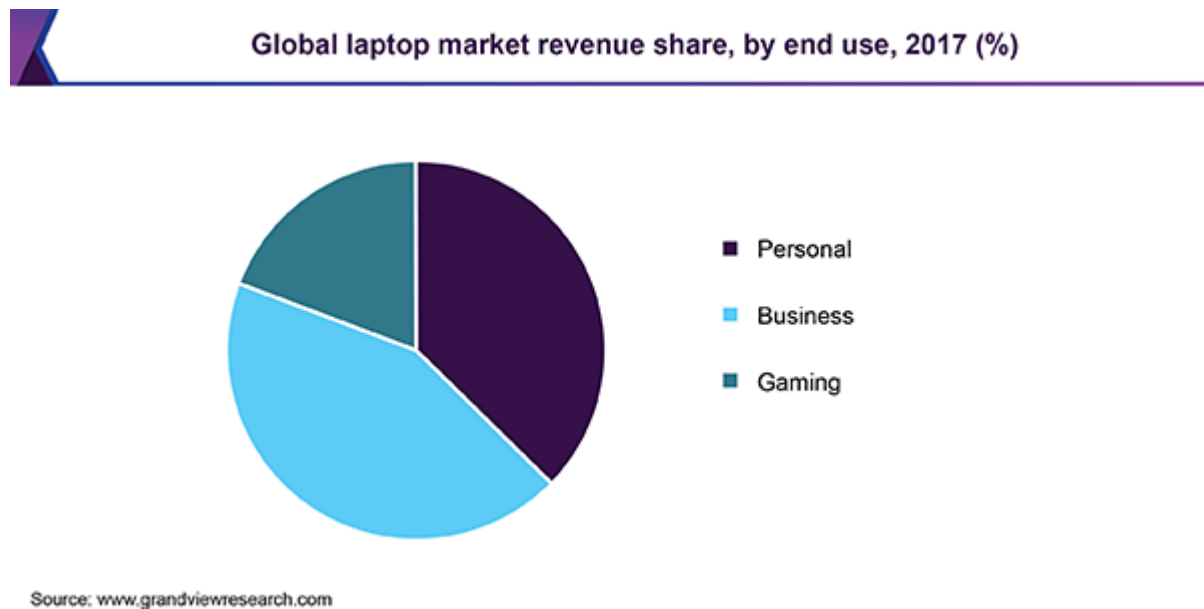
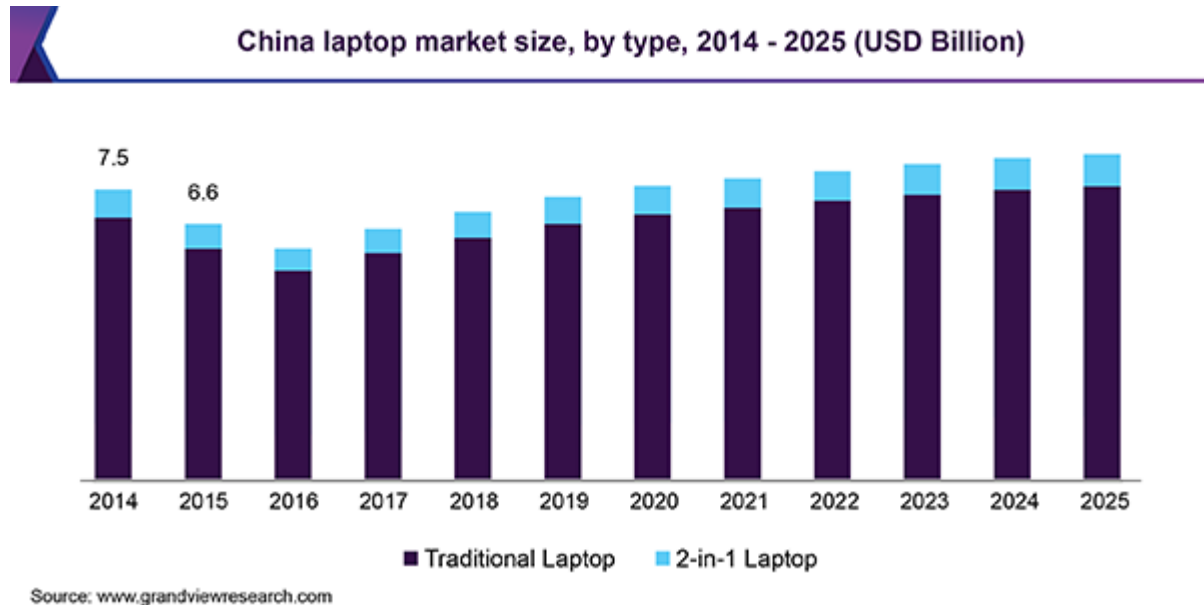
- Simplify the product and services
- Obtain new customers
- Win the industry-leading end-user computing solutions
- Scale alternative computing solutions

ModiFi's strategy with Rivals

ModiFi's strategy with rivals is centered on their mission statement which is to produce high quality products with competitive pricing. Additionally, ModiFi strives to serve customers with the best shopping experience and service support. This vision is the plan that ModiFi wants to execute to edge out competitors and rivals.

Section 1.5 Market sizing (revenue map) and market (customer) needs analysis

Market Sizing:



Target Revenue/Market Share:

- Total laptop market size: ~\$100 billion USD (notebooks, 2015)
- Market share goal: ~0.5% of total laptop market
- Revenue goal: ~\$500 million USD (mid-size)

Market Needs Analysis:

- Potential Markets

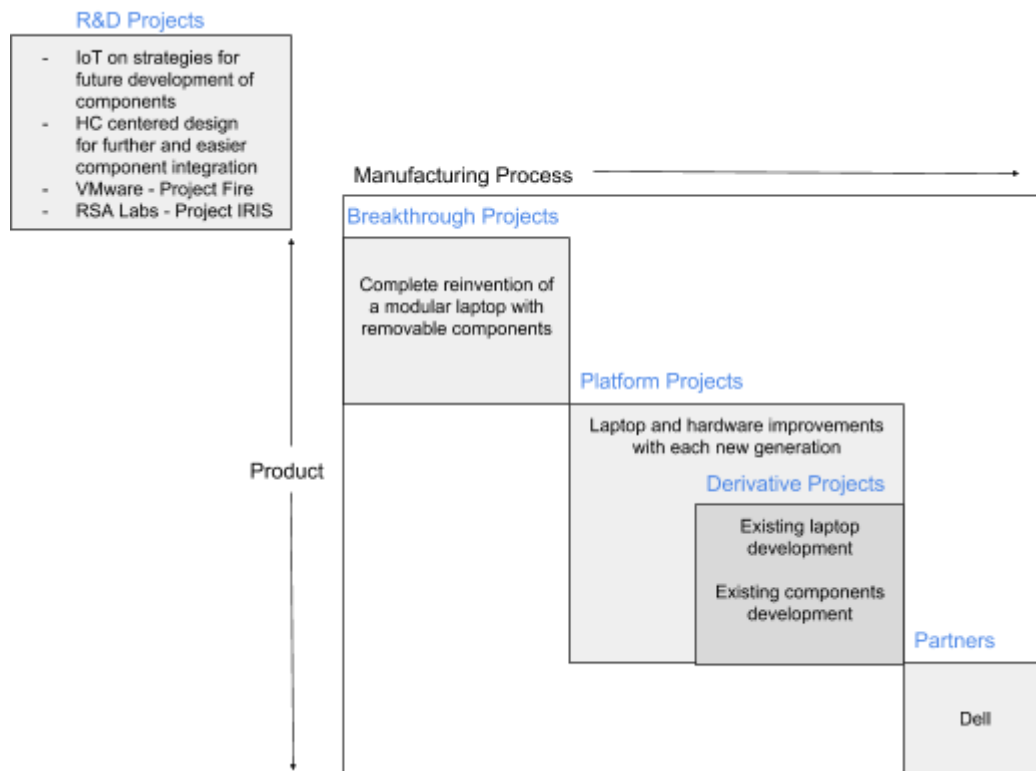
- Consumers
 - Everyday users (web browsing, email, basic applications)
 - Enthusiast users (gaming, video editing, rendering)
- Enterprises
 - Hardware manufacturers
 - Offices

- Customer Needs

- Consumers
 - Portability (Priority: **High**)
 - Performance (Priority: **Medium**)
- Enterprises
 - Longevity (Priority: **Medium**)
 - Cost-effectiveness (Priority: **Very High**)

Section 1.6 Aggregate Project Plan

Potential Project Landscape



Section 1.7 Preliminary Risk Analysis (Decision Trees/Decision Analysis)

A. Define the Problem:

Elaborate on what will be happening in the projects

- Four project options: R&D E1, P1, P2
- Total capital budget is **\$105M**
- Pose the associated integer-programming optimization problem to choose the project mix that will maximize expected monetary value(EMV)
- Solve the integer-programming problem via “Table-lookup” to determine which projects should be selected.
- What is the return on investment(ROI) on each project?
- How much cash is there left after the project selections are made? What should management do with this cash?

B. Plan the Treatment:

Project 1 and 2 (P1 & P2): P1 and P2 consists of the company focusing more on the everyday user so it could range from home to office usage. For P1, Research and development will be focusing on integrated graphics card since high graphics power would not be required for most everyday users. Furthermore, it will be cheaper since the product cost of integrated chips (GPU + CPU) are lower than dedicated and external GPU along with processor. The only difference is that P2 will also invest in dedicated and external GPUs for higher end users and apply for a patent which ensures that startups and established companies cannot use the technology for the products we are making. This will ensure a higher EMV if the project is successful because we will be securing most of the market share for modularized laptops. However, if the patent fails, other companies will be able to use similar technology so we would eventually lose the advantage we have on the modular technology. Patenting will only be used for project

2. Enterprise 1 (E1): This project would be focusing more on mid-top level tech industries along with art studios. Some of these firms will require more graphics computing power. Therefore, we will be conducting more of our research on dedicated and external GPU. This will make the production cost and the price of our products go up, but it will cost less in the long run because it is cheaper to swap out parts for upgrades or add parts for more computing power.

Research and Development (R&D): The objective of this project is to focus on the IoT, focuses on making the parts more easily integratable, and HC, focuses on making the parts more user friendly. This project will be an optional step after E1, P1, or P2 to further enhance the user experience and incentivize them to purchase our product.

- i. Look through table 1: Potential Development projects
- ii. Perform Decision analysis for each project to calculate EMV
- iii. Use integer programing to compare the projects
- iv. Calculate the total cash remaining afterwards
- v. Figure out what management should do with leftover cash.

Table 1: Potential Development Projects

Project/p roduct	Is product technically feasible (F)?		Will product development (D) be successful?		Will the product be patented(P)?		Time to market (month s)	Expected Monetary Value (\$M)
	Cost (\$M)	p(F)	Cost (\$M)	p(D)	Cost (\$M)	p(P)		
P1	1.25	0.85	20	0.9	N/A	N/A	12	250
P2	1.75	0.7	45	0.9	150	0.6	15	650
E1	2.25	0.65	55	0.8	N/A	N/A	13	800
R&D	3	0.75	15	0.7	N/A	N/A	2	150

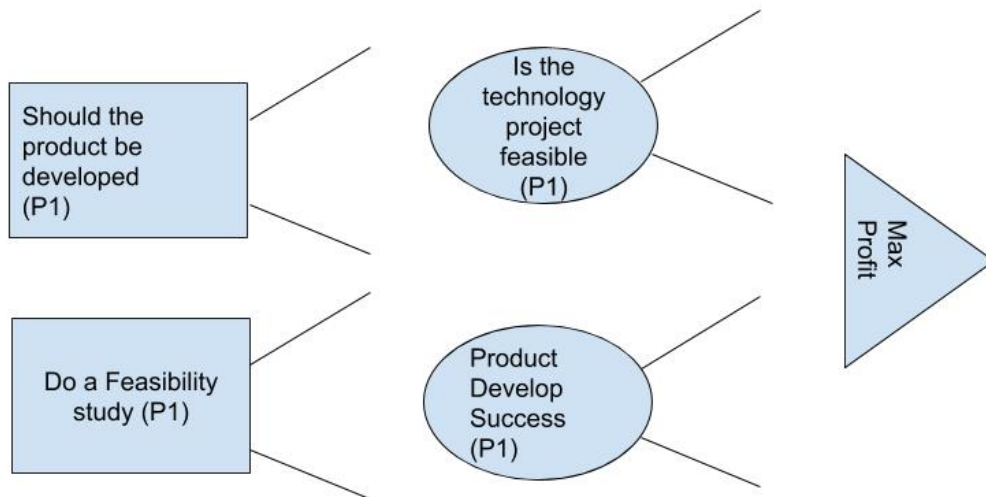
#	Project Mix				Project cost (\$M)				Project EMV (\$M)				Cumulativ e Cost (\$M)	Cumulativ e EMV (\$M)
#	P 1	P 2	E 1	R& D	P1	P2	E1	R&D	P1	P2	E1	R&D		
1	O	O	O	O	21.25	46.75	57.25	18	250	650	800	150	143.25	1850
2	O	O	O		21.25	46.75	57.25		250	650	800		125.25	1700
3		O	O	O		46.75	57.25	18		650	800	150	122	1600
4	O	O		O	21.25	46.75		18	250	650		150	86	1050

5		O	O			46.75	57.25			650	800		104	1450
6	O		O		21.25		57.25		250		800		78.5	1050
7	O		O	O	21.25		57.25	18	250		800	150	96.5	1200

C. Execute:

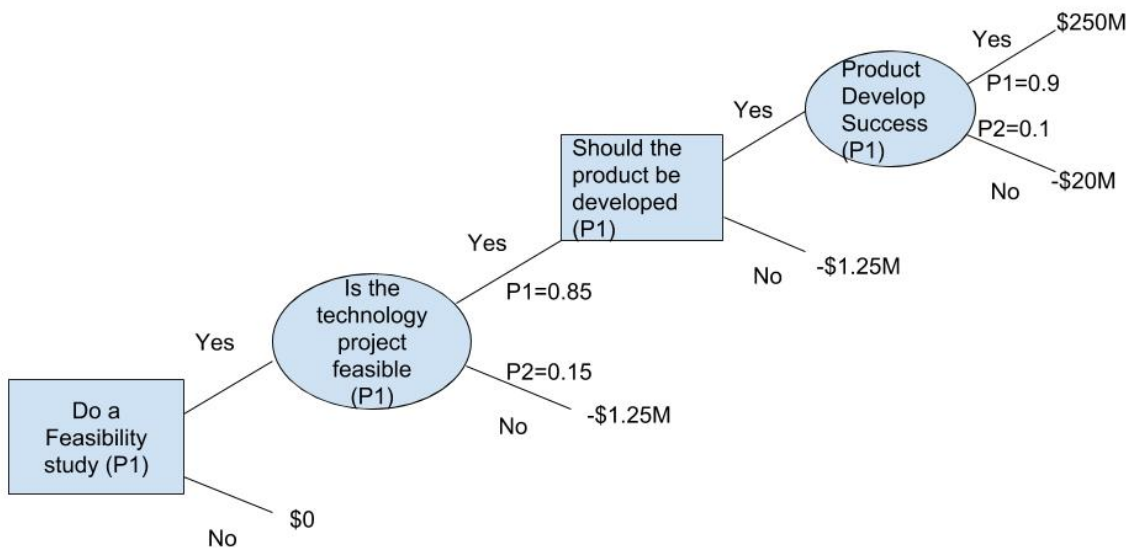
Project 1

Building blocks

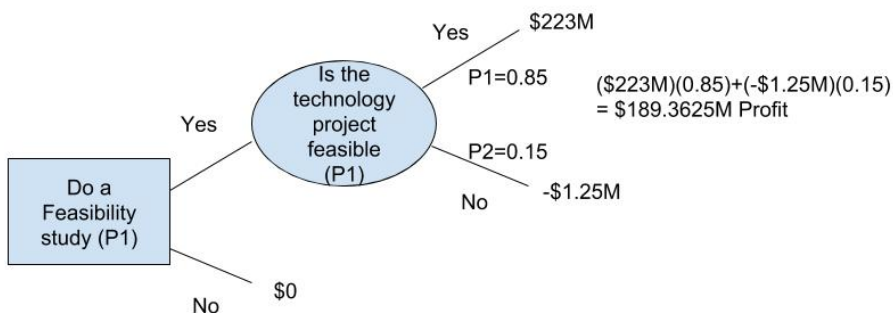
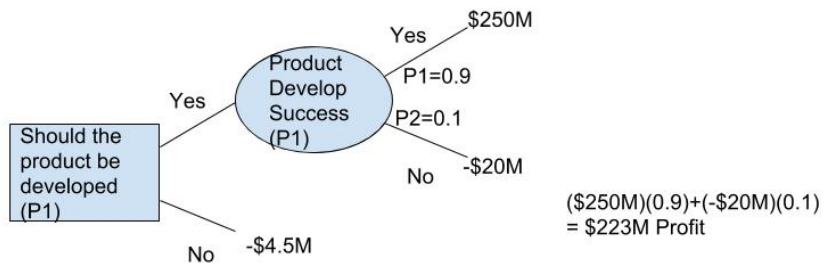


Influence diagram

Decision tree



Fold the Decision Tree Backwards



Sensitivity Analysis

-10%: I subtracted the product development success rate by 10% which gave me the value of $(0.8)(250) + (0.2)(-20) = \196M . This guarantees a positive payoff so we would go forward with the product development. I would then insert this value into conducting a feasibility research and subtract the value by 10% and get $(196)(0.75) + (0.25)(-1.25) = \146.6875M . This indicates that we can follow through and invest in the Project 1 because it has a positive payoff.

-20%: I subtracted the product development success rate by 10% which gave me the value of $(0.7)(250) + (0.3)(-20) = \169M . This guarantees a positive payoff so we would go forward with the product development. I would then insert this value into conducting a feasibility research and subtract the value by 20% and get $(169)(0.65) + (0.35)(-1.25) = \109.4125M . This indicates that we can follow through and invest in the Project 1 because it has a positive payoff.

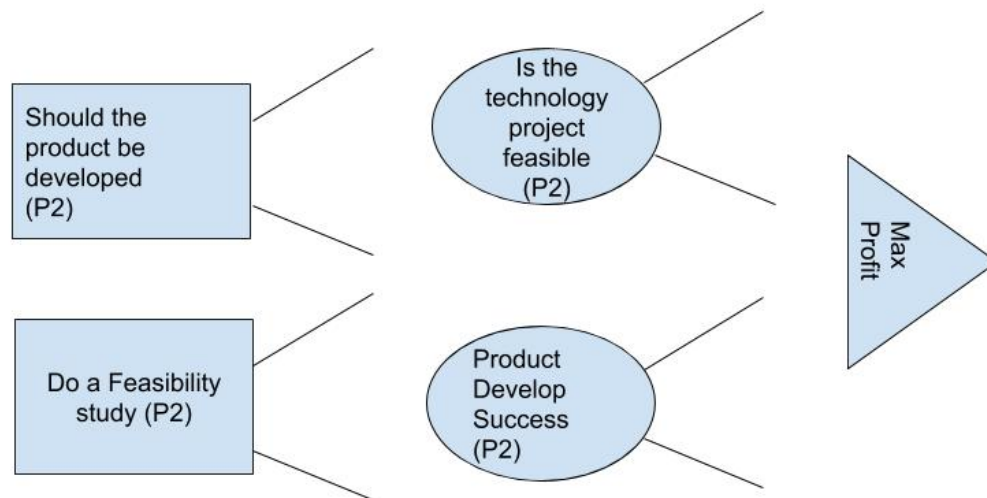
+10 and 20%: In the previous negative analysis I have conducted, it shows that we can gain profit from the decision we make. Doing a positive analysis would only further increase our profit for this project if we choose to pursue. This decision is robust and safe to pursue.

Decision for the Project

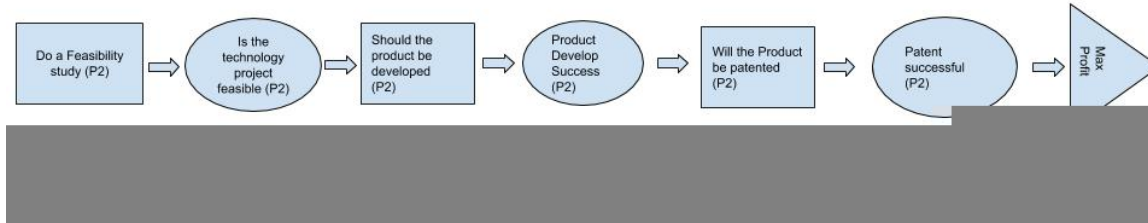
Yes, this project will can be funded for a potential payoff of \$189.3625M

Project 2

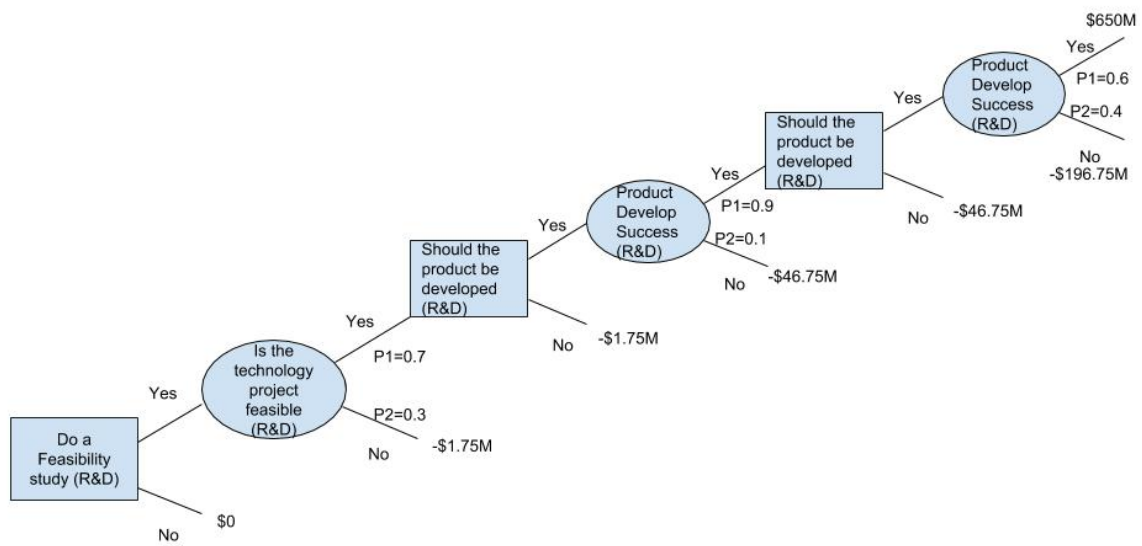
Building blocks



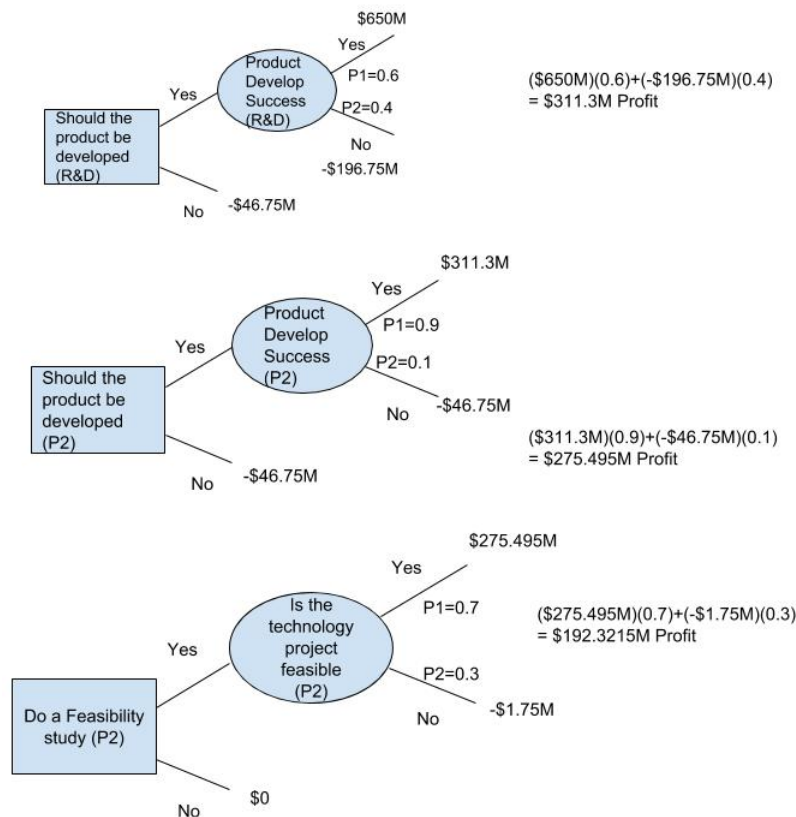
Influence diagram



Decision tree



Fold the Decision Tree Backwards



Sensitivity Analysis

-10%: I subtracted the patent success rate by 10% which gave me the value of $(0.5)(650) + (0.5)(-196.75) = \$226.625M$. This guarantees a positive payoff so we would go forward with the product success rate. I would then insert this value into product development subtract the value by 10% and get $(226.625)(0.8) + (0.2)(-46.75) = \$199.2875M$. Last but not least, we would insert this value into the feasibility study and subtract 10% and this will give us the value $(199.2875)(0.5) + (0.5)(-1.75) = \$118.8725M$. This indicates that we can follow through and invest in the Project 1 because it has a positive payoff.

-20%: I subtracted the patent success rate by 20% which gave me the value of $(0.4)(650) + (0.6)(-196.75) = \$141.95M$. This guarantees a positive payoff so we would go forward with the product success rate. I would then insert this value into product development subtract the value by 20% and get $(141.95)(0.7) + (0.3)(-46.75) = \$85.34M$. Last but not least, we would insert this value into the feasibility study and subtract 10% and this will give us the value $(85.34)(0.6) + (0.4)(-1.75) = \$50.504M$. This indicates that we can follow through and invest in the Project 1 because it has a positive payoff.

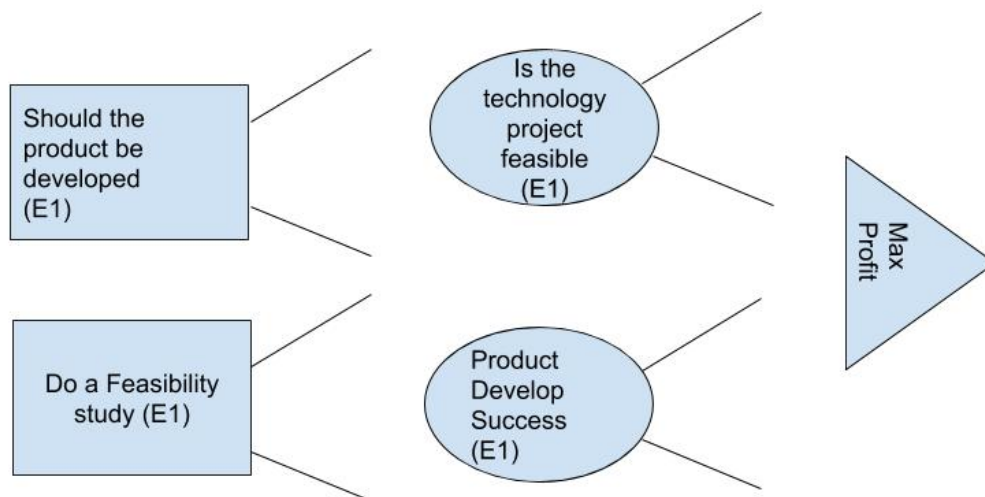
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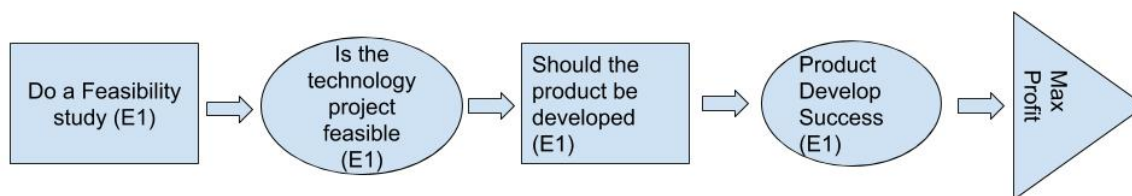
Yes, this project will can be funded for a potential payoff of \$192.3215M

Enterprise 1

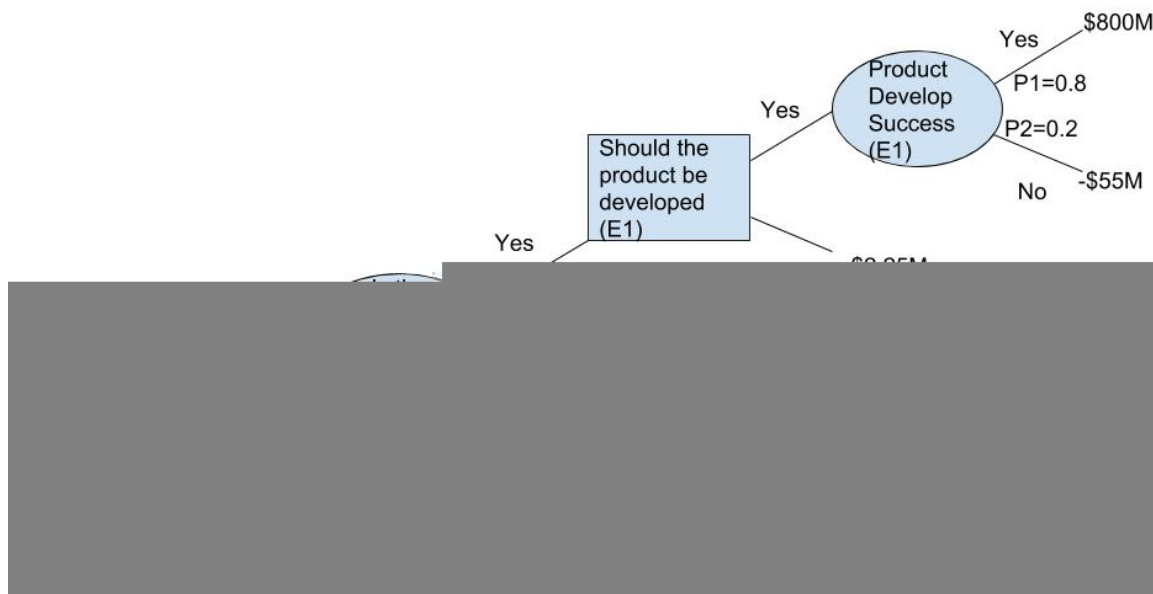
Building blocks



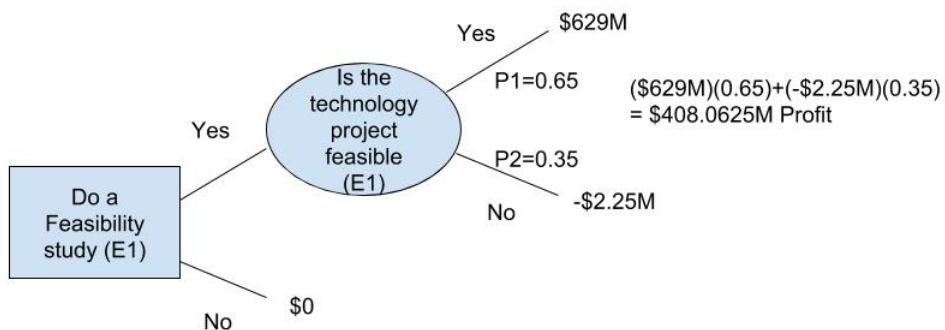
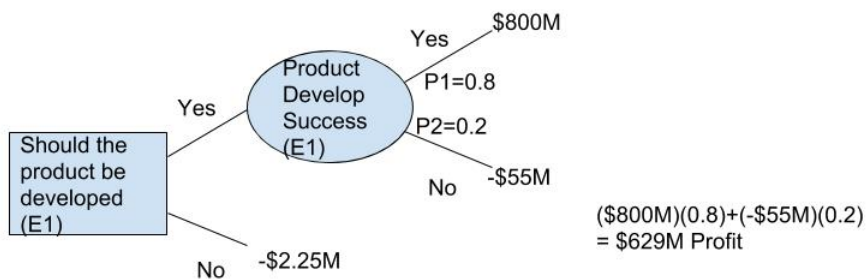
Influence Diagram



Decision Tree



Fold the Decision Tree Backwards



Sensitivity Analysis

-10%: I subtracted the product development success rate by 10% which gave me the value of $(0.7)(800) + (0.3)(-55) = \543.5M . This guarantees a positive payoff so we would go forward with the product development. I would then insert this value into conducting a feasibility research and subtract the value by 10% and get $(543.5)(0.55) + (0.45)(-2.25) = \297.9125M . This indicates that we can follow through and invest in the Enterprise 1 because it has a positive payoff.

-20%: I subtracted the product development success rate by 10% which gave me the value of $(0.6)(800) + (0.4)(-55) = \458M . This guarantees a positive payoff so we would go forward with the product development. I would then insert this value into conducting a feasibility research and subtract the value by 20% and get $(458)(0.45) + (0.55)(-2.25) = \204.8625M . This indicates that we can follow through and invest in the Enterprise 1 because it has a positive payoff.

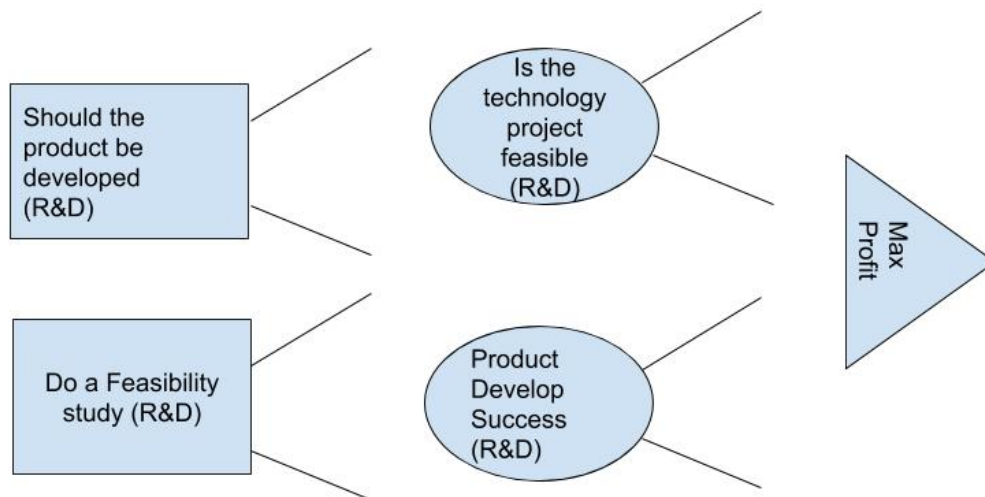
+10 and 20%: In the previous negative analysis I have conducted, it shows that we can gain profit from the decision we make. Doing a positive analysis would only further increase our profit for this project if we choose to pursue. This decision is robust and safe to pursue.

Decision for the Project

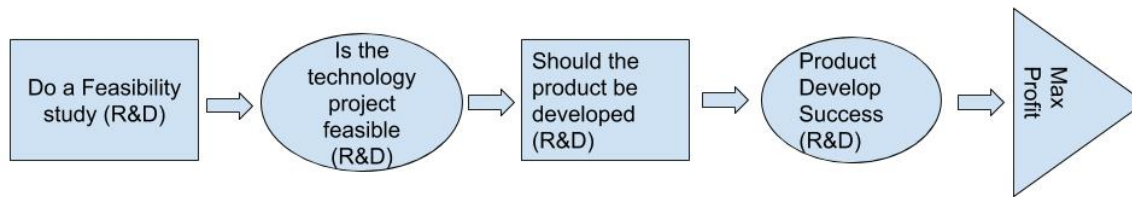
Yes, this project will can be funded for a potential payoff of \$408.0625M

Research and Development

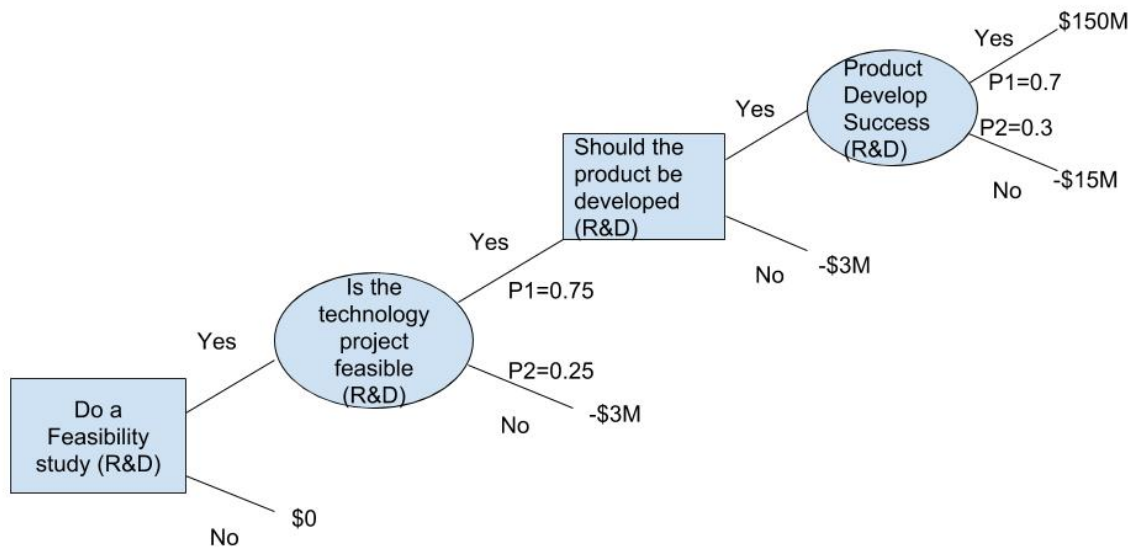
Building Blocks



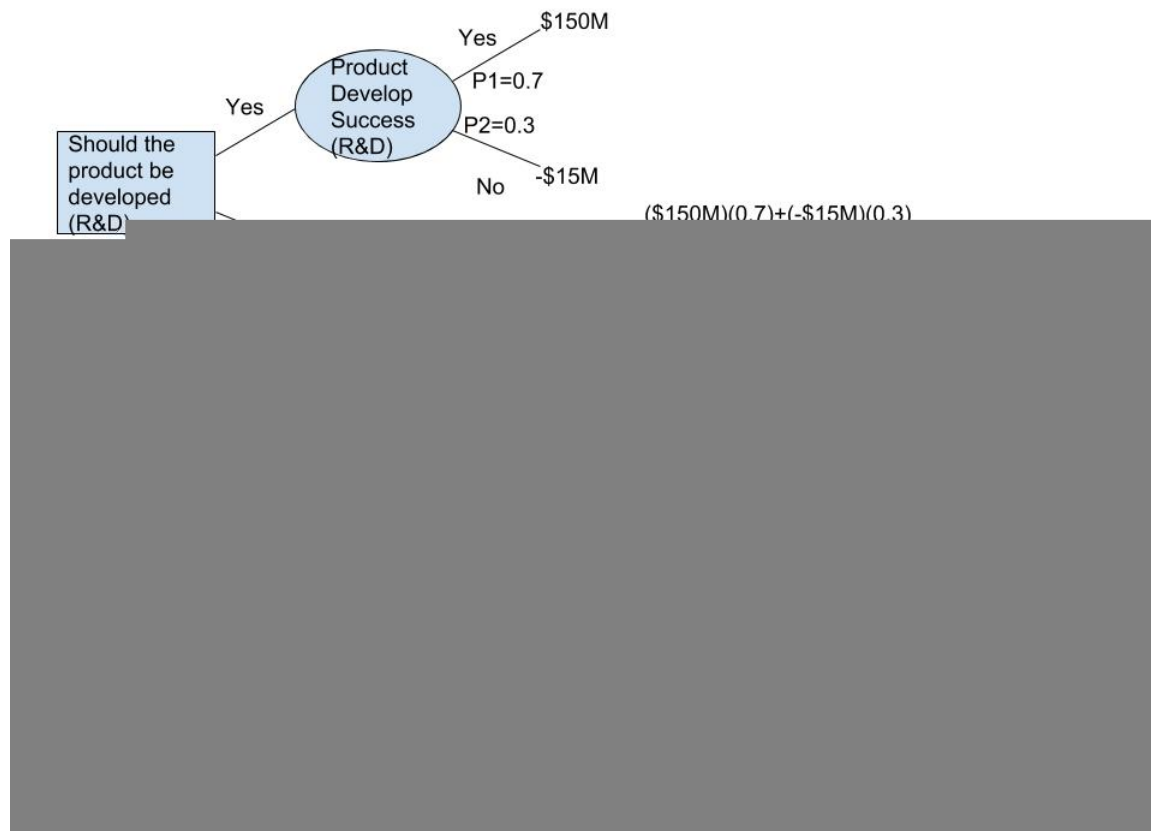
Influence Diagram



Decision Tree



Fold the Decision Tree Backwards



Sensitivity Analysis

-10%: I subtracted the product development success rate by 10% which gave me the value of $(0.6)(150) + (0.4)(-15) = \$84M$. This guarantees a positive payoff so we would go forward with the product development. I would then insert this value into conducting a feasibility research and subtract the value by 10% and get $(84)(0.65) + (0.35)(-3) = \$53.55M$. This indicates that we can follow through and invest in the R&D because it has a positive payoff.

-20%: I subtracted the product development success rate by 10% which gave me the value of $(0.5)(150) + (0.5)(-15) = \$67.5M$. This guarantees a positive payoff so we would go forward with the product development. I would then insert this value into conducting a feasibility research and subtract the value by 20% and get $(67.5)(0.55) + (0.45)(-2.25) = \$36.1125M$. This indicates that we can follow through and invest in the R&D because it has a positive payoff.

+10 and 20%: In the previous negative analysis I have conducted, it shows that we can gain profit from the decision we make. Doing a positive analysis would only further increase our profit for this project if we choose to pursue. This decision is robust and safe to pursue.

Decision for the Project

Yes, this project will can be funded for a potential payoff of \$74.625M

2.2 Table lookup

Project	Total cost(\$M)	EMV(\$M)
P1	26.25	168.75
P2	21.25	194.75

- The optimal project mix is R&D, P1, and E because it provides a profit of \$570.25M at the cost of \$86.5M with \$6.5M leftover after the project selection process

Conclusion:

- The best project selection is P1
- Regarding the leftover \$6,5M, I suggest the company saves it and adds it the next fiscal year budget. \$6.5M cannot fund another project. It can be distributed to other departments.

D. Check your work:

Based on the information given and under the assumption that there are no mathematical errors, I am certain my suggestions for which project to take on are correct.

E. Learn and generalize:

In real life companies make decisions similar to this to determine the profitability of their actions. Since the question asked to determine the set of options that would be most profitable. Under the specific budget constraint, it's clear that some options have large estimated monetary than others.

In addition, since combination mixes usually leave a remainder of money to be allocated elsewhere, it's very good to manage the money properly to help expand another field or system.

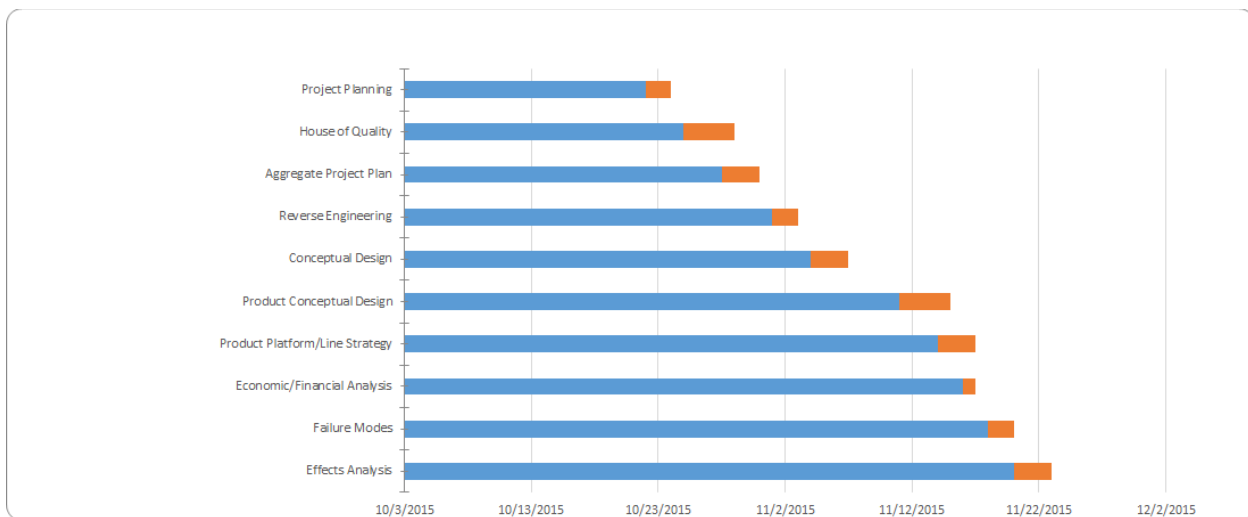
Project Phase II

Section 2.1 Project planning: Activities Matrix, GANTT, Pert, CPM for Phase 2 and Phase 3.

GANTT Chart

Task	Start Date	Duration	End Date
Project Planning	10/22/2018	2	11/13/2018

House of Quality	10/25/2018	4	11/13/2018
Reverse Engineering	10/28/2018	3	11/13/2018
Conceptual Design	11/1/2018	2	11/13/2018
Product Conceptual Design	11/4/2018	3	11/24/2018
Product Conceptual Design	11/11/2018	4	11/24/2018
Product Platform/Line Strategy	11/14/2018	3	11/24/2018
Economic/Financial Analysis	11/16/2018	1	11/24/2018
Failure Modes	11/18/2018	2	11/24/2018
Effects Analysis	11/20/2018	3	11/24/2018



Pert Chart

Project (or Program) Evaluation and Review Technique PERT



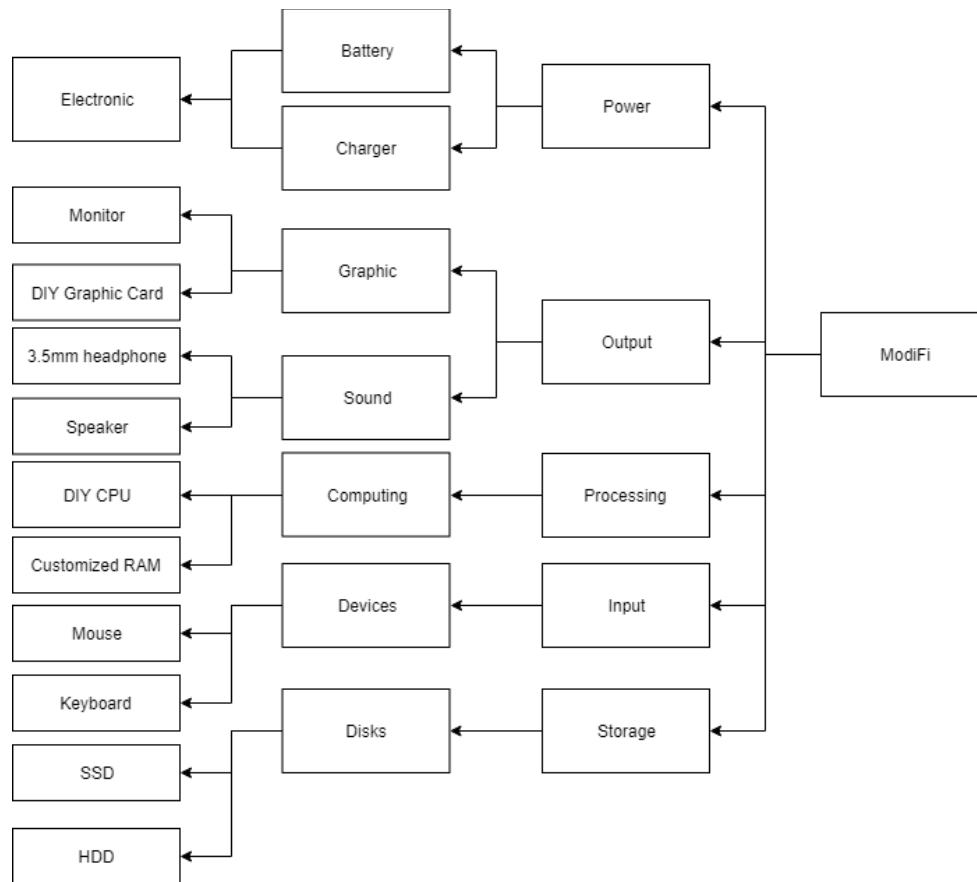
- After completing the PERT chart, the best critical path matrix we should follow is 1 > 3 > 4 > 5 > 6 > 7 > 8. This is because this path takes the least amount of time to complete. Subtask 3 is one week faster than Subtask 4 (3 weeks vs. 4 weeks)

Critical Path Method(CPM)

Section 2.2 House of Quality

FAST Diagram

FAST Diagram

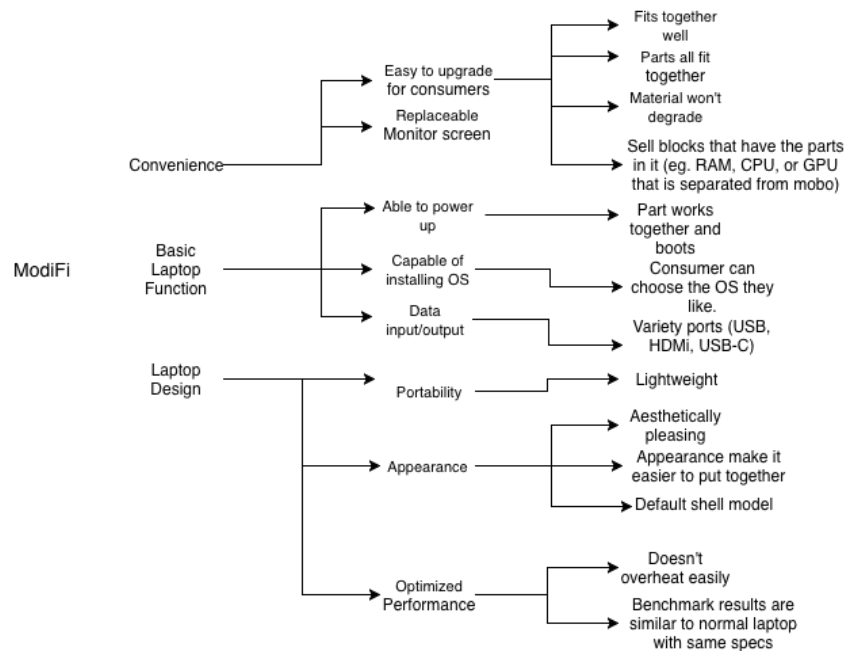


House of Quality

Step 1: Make a structured and prioritized list of the customer needs for the intended product based on market research. Assess the importance of each need using the convenient scale.

Primary	Secondary	Tertiary
Convenience	<ol style="list-style-type: none"> 1. Easy to upgrade for consumer 2. Replaceable monitor screens 	<ol style="list-style-type: none"> 1a. Fits together well 1b. Parts all fit together easily 1c. Parts are replaceable 1d. Sell blocks that have the parts in it (eg. RAM, CPU, or GPU that is separated from mobo)
Retain Basic Laptop Functions	<ol style="list-style-type: none"> 1. Capable of installing operating system 2. Data input and output 3. Able to power up 	<ol style="list-style-type: none"> 1a. Consumer can choose the OS they like. 2a. Variety ports (USB, HDMi, USB-C, and AUX) 3a. Part works together and functions

Laptop Design	1. Portability 2. Appearance 3. Optimized Performance	1a. Lightweight 2a. Aesthetically pleasing 2b. Appearance makes it easy to put together 2c. Default shell model 3a. Doesn't overheat easily 3b. Benchmark results are similar to normal laptop with same specs
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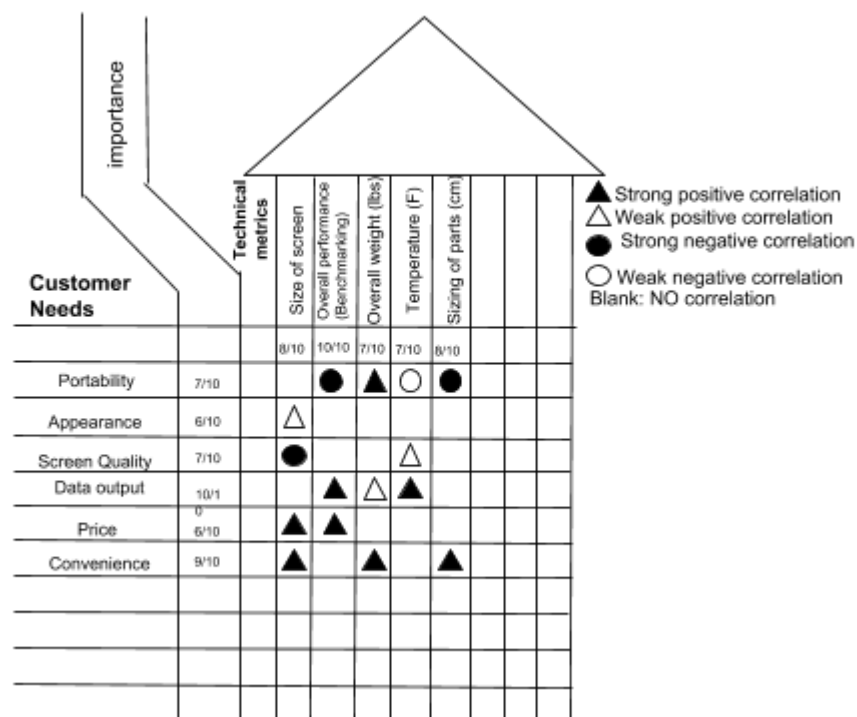


Customer Needs	Importance Scale (1-10)
Portability	7/10
Appearance	6/10
Convenience	10/10
Data Input and Output	10/10
Price	6/10
Screen Quality	7/10

Step 2: Make a list of the technical metrics and assess the importance of each metric using a convenient scale.

Technical Metrics	Importance Scale (1-10)
Sizing of parts (inches)	8/10
Overall Performance (Benchmarking)	10/10
Overall weight (lbs)	7/10
Sizing of the screen (inches)	8/10
Temperature (°F)	7/10

Step 3: Correlate customer needs and the technical metrics (engineering requirements) using a convenient scale. The result is called a correlation matrix.



Step 4:

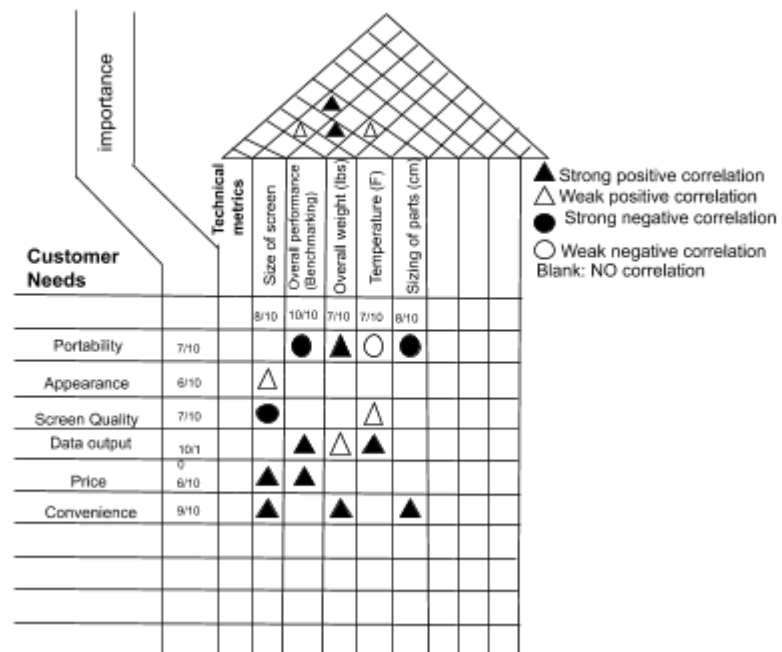
4a. Correlate the technical metrics to each other using a convenience scale.

Technical Metric Scale (TM)	Sizing of Parts (inches)	Overall Performance (Benchmarking)	Overall Weight (lbs)	Sizing of the screen (inches)	Temperature
Sizing of Parts (inches)	+		+ -	+	
Overall Performance (Benchmarking)		+			+
Overall Weight (lbs)	+ -		+	+ -	
Sizing of the screen (inches)	+		+ -	+	
Temperature		+			+

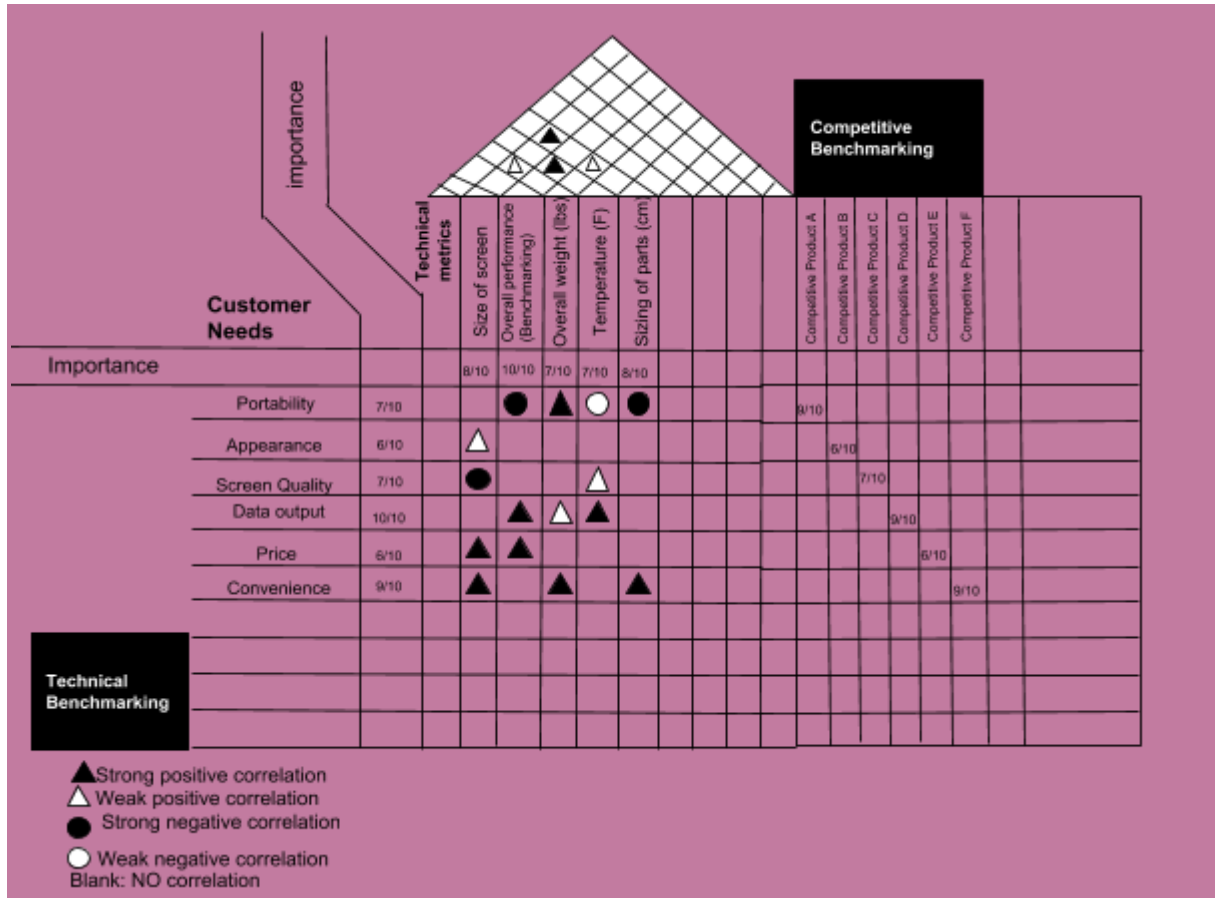
○

- +: Strong Positive Correlation
- + -: Weak Positive Correlation
- - : Strong Negative Correlation
- Blank: No Correlation

4b. Place “Half” of the matrix on top.



Step 5: Benchmarking



Assess a set of competing products from the viewpoint of the customer on the functionality of the laptop(customer benchmarking), and from a technical engineering viewpoint (technical benchmarking) and engineering units of measurement for the technical benchmarking.

Step 6: Set targets for customer needs and technical metrics for a new product.

Target Customer Needs	Target Technical Metrics
<ul style="list-style-type: none"> ● Portable like a laptop ● Able to run all basic software available to a laptop ● Easy to upgrade parts for consumers ● Sturdy through time <ul style="list-style-type: none"> ○ Still works after 10 years so that it's upgradable 	<ul style="list-style-type: none"> ● Standardization for all parts <ul style="list-style-type: none"> ○ PCIe connections ● Parts are able to work together <ul style="list-style-type: none"> ○ Manufacturer software drivers for all relevant parts ● Benchmarking numbers <ul style="list-style-type: none"> ○ 1080p screen ○ Battery lasts 9 hours

	<ul style="list-style-type: none"> ○ File Transfer rate - 1272.40 Mbps ○ Geekbench 4 (16722) ○ Processing power (mm:ss) - 1:00 ○ Display brightness (Nits) - 209 ○ Color gamut 209 ● Weight below 5kg
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Section 2.3 Reverse Engineering

Products:

Acer c720 Chromebook



Properties

- Screen: sharp 1366x768 LED Backlit Display 1X HDMI Port
- Processor: 1.4 GHz Intel Celeron(Haswell)
- RAM: 2 GB DDR3L SDRAM
- Storage: 16 GB Flash Memory
- Wireless: Acer InviLink™ Nplify 802.11 a/b/g/n Bluetooth 4.0
- Expansion Ports: 1X USB 2.0 1X USB3.0
- Battery: 3-Cell Li-Polymer Battery(3950 Mah)
- Weight: 2.8 LBS
- Operating System Chrome

FAST Diagram

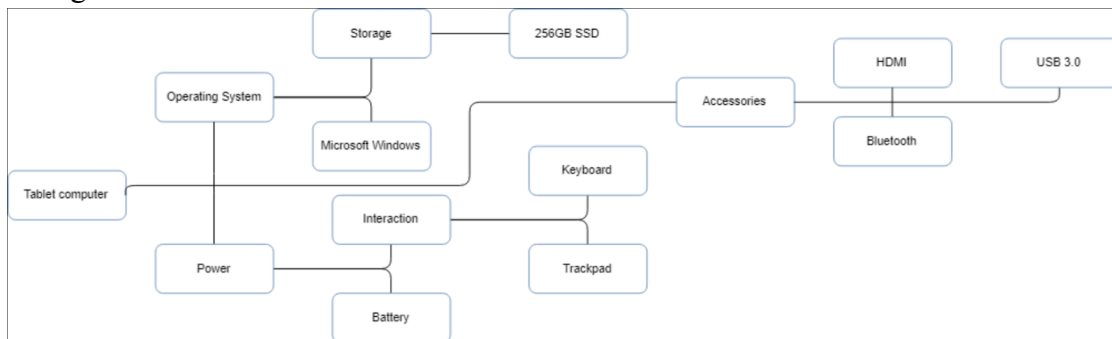
Microsoft Surface Pro 4



Properties

- Screen: 12.3-inch, 2,736 x 1,824 PixelSense display
 - (Contrast ratio: 1,300:1, 100% sRGB color, 10-point multi-touch, 3:2 aspect ratio)
- Processor: 2.4GHz Intel Core i5-6300U
- RAM: 8GB LPDDR3
- Storage: 256GB SSD
- Ports: 1x USB 3.0, mini DisplayPort, microSD card reader (UHS-I), headphone/mic jack
- Wireless 802.11ac WiFi (2x2 MIMO), Bluetooth 4.0
- Expansion Ports: 1X USB 2.0 1X USB3.0
- Battery: 3-Cell Li-Polymer Battery(3950 Mah)
- 802.11ac Wi-Fi (2 x 2 MIMO), Bluetooth 4.0
- Weight: 1.73 pounds
- Operating System Windows

FAST Diagram



Hp Stream 14



Properties:

- CPU. Intel Celeron N3060 211.
- GPU. Intel HD Graphics 400 (Braswell) 222.
- Display. 14.0", HD (1366 x 768), TN.
- HDD/SSD. 64GB eMMC
- RAM. 4GB, 1600MHz
- OS: Windows
- Battery. 41Wh, 3-Cell

FAST Diagram



Section 2.4 Conceptual Design

Step 1: Establish customer needs and technical metrics (specifications) for the new product using the HOQ.

- See HOQ above.

Step 2: Identify the main or primary function of the product (the product intent)

- Primary function (product intent):
 - To serve as a fully modular, functioning laptop that can be upgraded or repaired piece by piece.

Step 3: Identify one or more related products, and then reverse engineer (dissect) these product using FAST.

- See FAST dissection above.

Step 4: Create an abstract functional representation of the new (intended) product, called the Function Structure (FS).

1. Express the overall function for the design in terms of the conversion of inputs into outputs

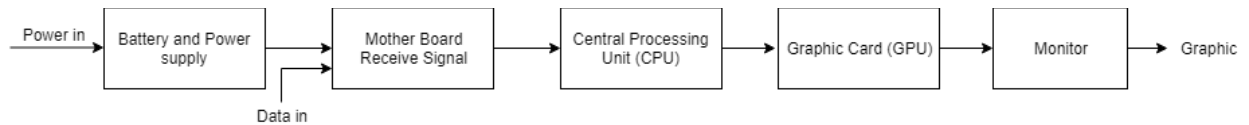


2. Break down the overall function into a set of essential subfunctions

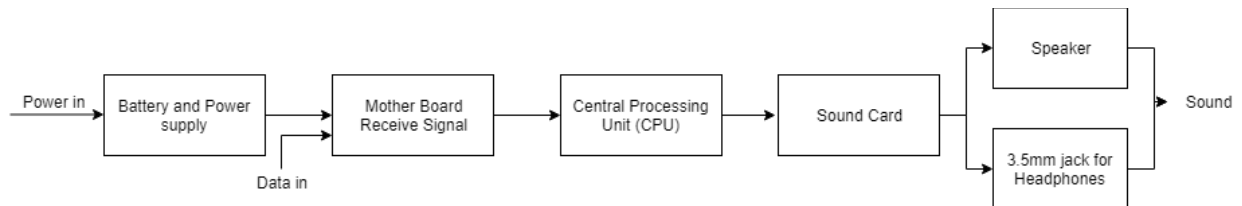
a. Sub-function1: Computing



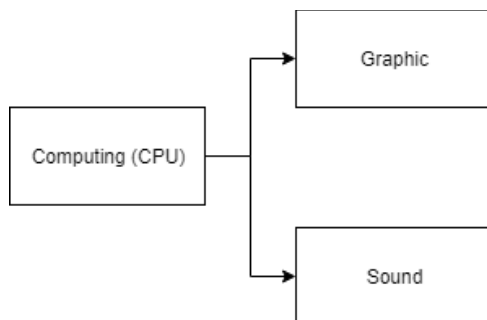
b. Sub-function 2: Graphic



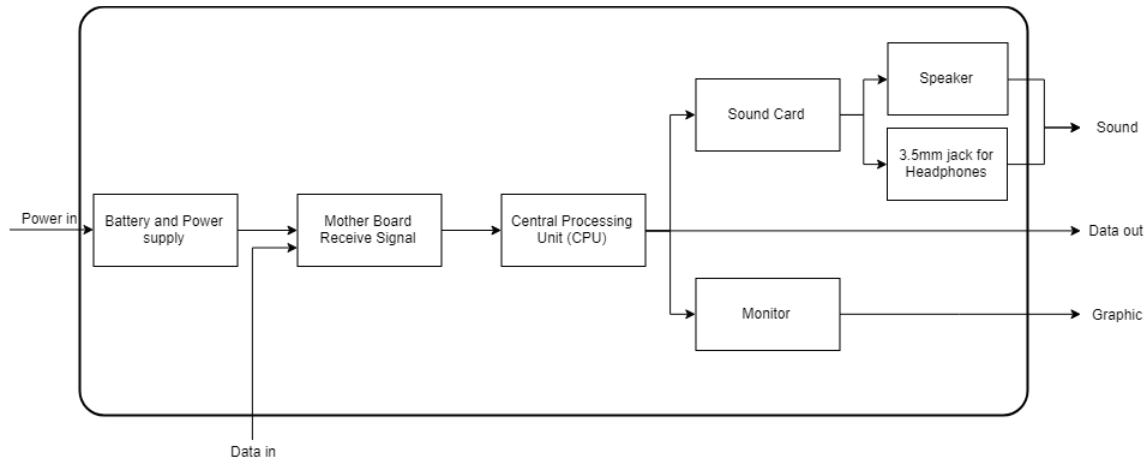
c. Sub-function 3: Sound



3. Draw a block diagram showing the interactions between subfunctions



4. Draw the system boundary



5. Search for appropriate components for performing the subfunctions and their interactions

- Computing - Central processing unit/Motherboard/Battery
- Graphic - Central processing unit/Motherboard/DRAM/Graphics processing unit/Monitor/Battery
- Sound - Central processing unit/Sound card/Speakers/Battery/Motherboard

Step 5: Solution Principles.

- (i) For each sub-functions, generate alternative solution principles (SPs) for realizing that sub-functions.
- (ii) Organize these solution principles (SPs) in a morphological matrix (MM).

	Solution Principle 1	Solution Principle 2	Solution Principle 3	Solution Principle 4

Step 6: Generate 6-10 alternative concepts by suitably combining the solution principles in the MM.

Alternative concepts:

1. Laptop with USB-C and Liquid Cooler

	Solution Principle 1	Solution Principle 2	Solution Principle 3	Solution Principle 4
SF1 (Power)	Electricity			
SF2 (CPU)	Intel	AMD		
SF3 (RAM)	Sandisk	Corsair	Kingston	HyperX
SF4 (Graphic Card)	Dedicated Graphic Card	External Graphic Card	Integrated Graphic Card	No Graphic Card
SF5 (Sound Card)	Dedicated Sound Card	Integrated Sound Card		
SF6 (Battery)	AC Adapter	DC Adapter	USB-C	Wireless

```
graph TD; E[Electricity] --> I[Intel]; I --> C[Corsair]; C --> DGC[Dedicated Graphic Card]; DGC --> ISC[Integrated Sound Card]; ISC --> USB[USB-C];
```

This laptop is a high level technology laptop with dedicated graphic card, integrated card and USB-C connection. USB-C port is a new technology that can not only transport data, but also

charge the laptop. With IPS display, this monitor is more colorful and has better visual experience. Liquid cooler in this laptop will bring a better environment for the laptop, prevent from overheat.

2. Laptop with all components integrated on the motherboard.

	Solution Problem 1	Solution Problem 2	Solution Problem 3	Solution Problem 4
--	-----------------------	-----------------------	-----------------------	-----------------------

This laptop is the most portable laptop, since most of the components are integrated on the motherboard, such as graphic card and sound card. Which makes more space for the laptop, and manufacturers can make it thinner and smaller.

3. Gaming Laptop: with external graphic card, dedicated sound card and gaming RAM

	Solution Principle 1	Solution Principle 2	Solution Principle 3	Solution Principle 4
SF1 (Power)	Electricity			
SF2 (CPU)	Intel	AMD		
SF3 (RAM)	Sandisk	Corsair	Kingston	HyperX
SF4 (Graphic Card)	Dedicated Graphic Card	External Graphic Card	Integrated Graphic Card	No Graphic Card
SF5 (Sound Card)	Dedicated Sound Card	Integrated Sound Card		
SF6 (Battery Charing)	AC Adapter	DC Adapter	USB-C	Wireless
SF7 (Cooling System)	Fan Cooler	Liquid Cooler		
SF8 (Operating System)	Windows	Mac OSX	Linux	
SF9 (Monitor)	TN	IPS	VA	LED
SF10				

HyperX RAM will bring a better performance on gaming memory storing, an external graphic card is connect with the laptop, which will enhance the performance of gaming and video decoding. Liquid cooler will prevent from overheating. This laptop is made for gamers and Tech-influencers, but not portable.

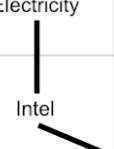
4. Mac-OSX based laptop

	Solution Product 1	Solution Product 2	Solution Product 3	Solution Product 4
--	-----------------------	-----------------------	-----------------------	-----------------------

This laptop is based on Macbook, using integrated graphic card and integrated sound card, USB-C for more convenient data connection and battery charging. The operating system is Mac OSX, which bring users a entirely new experience of operating system. The LED display brings better visual performance but it is more expensive.

5. New technology laptop

	Solution Principle 1	Solution Principle 2	Solution Principle 3	Solution Principle 4
SF1 (Power)	Electricity			
SF2 (CPU)	Intel	AMD		



This laptop is a laptop using new technologies such as wireless charging, VA display and liquid cooling system. The performance of this laptop cannot be guaranteed, but the new

technology will bring users an entirely new experience. With the time passed, these new technologies will get much more mature.

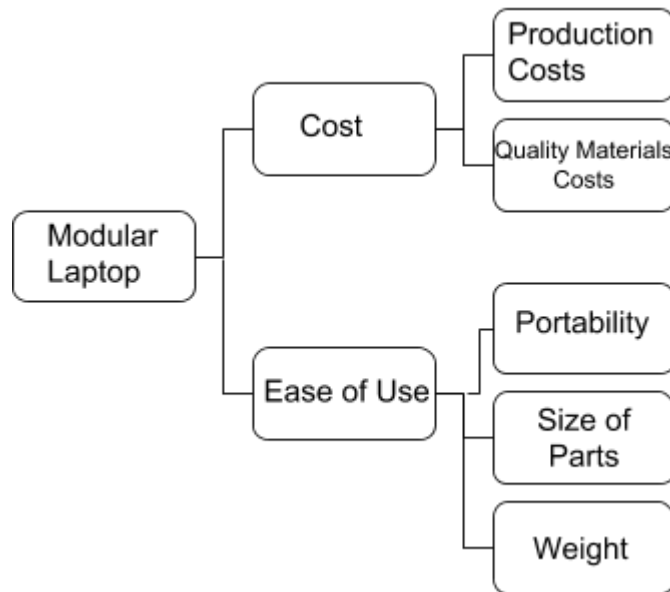
6. Programming based laptop

	Solution	Solution	Solution	Solution
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This laptop is made for people doing coding and programming work. With Linux operating system, users will have a better computer environment to test and run their code. With USB-C, they can send and receive data quicker.

Step 7: Identify an appropriate set of selection criteria to assess/compare the alternative (from Step 6)and use these criteria to create a utility function (UF).

1. Selection criteria:



2. Utility Function (UF):

Step 8: Use the UF to compare the alternatives (from step 6) and select one (or two) feasible concepts for further development.

1. Alternative comparison (with UF):

1. Laptop with USB-C and Liquid Cooler
2. Laptop with all components integrated on motherboard
3. Laptop with External graphic card and dedicated sound card
4. Laptop with Mac operating system
5. Laptop with wireless charging and VA display
6. Laptop made for programming needs.

Compare the design alternatives w.r.t. each selection criteria

- *Concept Rating Scale: 1-5*

Selection Criteria	Absolute Weight	Concept 1		Concept 2		Concept 3		Concept 4		Concept 5		Concept 6	
		Concept Rating	Utility	Concept Rating	Utility	Concept Rating	Utility	Concept Rating	Utility	Concept Rating	Utility	Concept Rating	Utility
S₁ (Portability)	0.42	4	1.68	5	2.1	2	0.84	4	1.68	3	1.26	4	1.68
S₂ (Part Size)	0.14	4	0.56	4	0.56	3	0.42	4	0.56	3	0.42	4	0.56
S₃ (Weight)	0.14	4	0.56	5	0.70	2	0.28	4	0.56	4	0.56	4	0.56
S₄ (Product Costs)	0.12	4	0.48	2	0.24	4	0.48	3	0.36	1	0.12	2	0.24
S₅ (Quality Material Costs)	0.18	5	0.90	3	0.48	5	0.90	4	0.72	2	0.36	4	0.72
CUs = $\Sigma(\text{utility})$	1.0		4.18		4.08		2.92		3.88		2.72		3.76

2. Final selections (Select 1-2 feasible concepts with highest CUs):

1. The two most feasible concepts with the highest CUs will be Concept 1 and Concept 2.

Learn your Generalize:

Though all the work shown above and the resources listen below we have learned a lot about the steps making a conceptual design, how to decomposition a product, how to make a function structure for the product and how to compare several alternatives using UF.

Section 2.5 Phase II Report

The overall schedule of the project is on time according to our GANTT chart we will be submitting our phase two Tuesday 11th of November 2018. The project is proceeding as planned and the overall health of the project is good. We can affirm this due to the hard due date of each phase and deliverables (i.e. GANTT chart, reverse engineering, house of quality, and conceptual design to name a few). The only hiccup of our modular laptop project has been a misunderstanding and correction of the mid sized company not a large size company. We corrected that during our phase one review and are moving forward.

We have completed our first project milestone preliminary proposal, overall strategy on the 23rd of October 2018 and currently completing the next milestone product Design and Development along the Product Platform to be completed on the 13th of November 2018. Our next milestone of commercialization, product architecture and Product line strategy and financial analysis will be completed November 20th 2018. And our final milestone will be completed on the 27th of November.

While we have completed our first milestone due to labour strikes our second milestone has been postponed a week behind schedule. We are one week behind schedule. Overall we are on time to present our project.

To address for the variance of the labour strikes and being behind schedule one week our team have responded by being more thorough with our calculations between budgeting and our time frames being more conservative and accounting for more latencies.

Overall the project due to the labour strike delays is still operating within its expected timelines. Additional delays add additional cost and resources which we are running very tightly. The next milestone of Commercialization: Product Architecture and Product Line Strategy; financial analysis; Quality; Robustness will be completed the 20th of November 2018.

Section 3.1 Prototyping Strategy

Core/supporting technology of ModiFi modular laptop

Core technologies	<ul style="list-style-type: none">• An injection mold with metal tab inserts laptop shell
Supporting technologies	<ul style="list-style-type: none">• 1080p hd samsung screen• RelTeck touchpad

	<ul style="list-style-type: none"> • Cisco Wifi enabled NIC card • HP 15x8 motherboard chassi
--	---

Critical Path: 1 -> 2 -> 3 ->3 ->4

Section 3.2 Product Platform/Line Strategy

Product platform line strategy:

Step 1: Create the core or defining technology elements that are unique.

- **PCIe Connections** - PCI express connections to transmit data between components
- **Hardware Shell Casings (chassis)** - Metal shells to house third-party components and the PCIe connections between them.
- **Driver Software** - Open source software for maximum compatibility between third-party components.
- **Motherboard** - Connects all parts and transfers data between them

Step 2: Determine the supporting technology elements necessary to obtain a functional working product.

- **Centralized Processing Unit (CPU)** - Processing binary code

- **Graphical Processing Unit (GPU)** - Responsible for processing images
- **Battery** - Supplies the power to the laptop parts
- **Monitor Screen** - Displays the pixels generated by the GPU
- **Keyboard** - Allows user input
- **Trackpad** - Tracks user input
- **RAM** - Temporary storage space for when the laptop process data
- **USB ports** - Allows external input
- **HDD/SSD** - Permanent storage space

Step 3: For each target market segment, use the product platform to create a product line to serve that segment.

Consumer

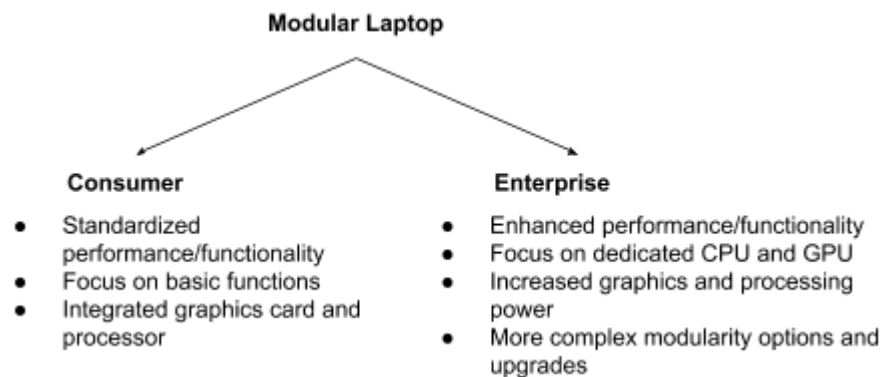
- Standardize performance (efficient enough to complete basic functions for enterprises)
 - Focuses on integrated graphics card and processor
- Simplify modularity for general consumers to upgrade (ease of upgrading)

Enterprise

- Enhanced performance/functionality
 - Increased graphics and processing power for enterprise usage such as established tech companies
 - Focuses on dedicated and external gpu and cpu
- More complex modularity for Enterprises as specialize employees can upgrade parts for enterprises

Overall

- Research and development that focuses on user experience for all consumers
 - Makes the parts more easily integratable
 - Focuses on making the design more user friendly



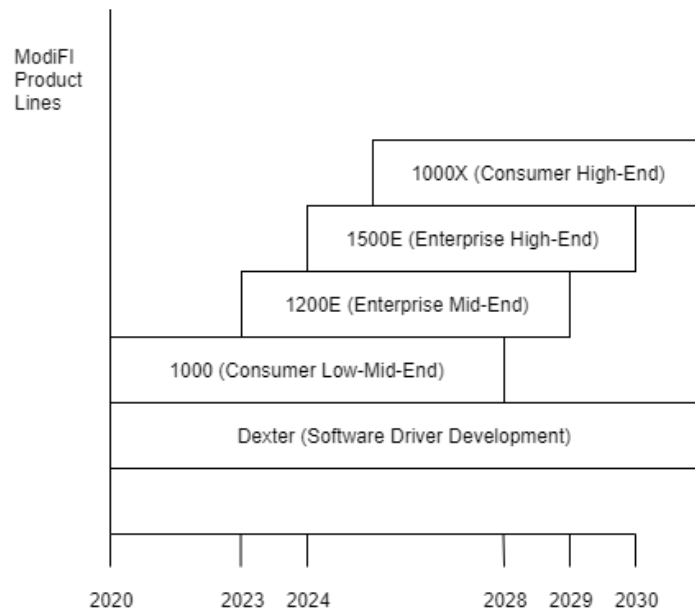
Step 4: For each product line, create the necessary project plan to introduce each product line to its target market segment.

Step 5: Introduce product lines (to the market segments in a time-phased manner to “cover” (reach) all the desired target market segments).

Segments:

Consumer Low-End
 Consumer Mid-End
 Mid performance enterprise
 High performance enterprise
 Upgradability

Segments	2020	2023	2024	2025
Consumer Low-End	✓			
Consumer Mid-End	✓			
Consumer High-End				✓
Enterprise Mid performance		✓		
Enterprise High performance			✓	
Software Driver Support	✓	✓	✓	✓



Section 3.3 Failure Modes and Effect Analysis(FMEA)

Step 1: Enter the part name and number. Each part must be considered individually and assessed for its potential to fail.

Step 2: Enter the function of the part and what it is required to do. Some parts have more than one function.

Step 3: For each of the functions listed in the step 2 enter the potential failure modes.

Step 4: For each of the failure modes identified in step 3 describe the consequences or effects of the failure.

Step 5: This step uses the customized severity table to make an assessment of the numerical rating which can be attributed to the most serious effect due to the potential failure. The numerical value is now entered in the table.

Step 6: Enter the potential causes of the failure mode. Here one should try to emphasize the root cause of the failure. This can be done by asking why, why, why... sequentially until a root cause of the failure is found.

Step 7: Enter the occurrence rating for each cause of the failure that has been identified in step 6 using the customized occurrence table.

Step 8: Now the engineer has to consider how the process which is in place can help to detect the potential failure mode.

Step 9: Enter a rating from the detection part of the table which reflects most closely the ability to detect the cause of the failure which has been identified in step 8

Step 10: Calculate the risk priority number (RPN). This number is calculated by taking the product of the severity, occurrence and detection ratings, or $RPN=S \times O \times D$

Step 11: Assess the most important FMEAs by comparing the RPN scores. Decide which set of these should be actioned first.

Severity of Failures:

Customer does not know how to install external GPU/CPU

Customer choose to use standard laptop over modularized laptops

Customer is unable to piece together the modular laptop

Customer endangered (Electric shock from open currents)

Hardware/software compatibility (Laptop does not run) - High severity

Minor bugs noticed by customers but does not have effect on function

Minor bugs noticed by customers but has an impact on product function

Number	Weight	Frequency	Potential effects of	Potential causes of	How will the potential	Notes	Assessment
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Rating: Lowest number will be prioritized the most

Rating	Severity	Occurrence	Detection
1	Customer choose to use standard laptop over modularized laptops	Moderate	Very High
2	Hardware/software compatibility (Laptop does not run)	Low	Moderate
3	Minor bugs noticed by customers but does not have effect on function Minor bugs noticed by customers but has an impact on product function	Very High	Very High
	Minor bugs noticed by customers but does not have effect on function Minor bugs noticed by customers but has an impact on product function		
5	Customer endangered (Electric shock from open currents)	Very low	Very High
6	Customer does not know how to install external GPU/CPU	Low	Very High
7	Customer is unable to piece together the modular laptop	Low	High

Section 3.4 Economic/Financial Modeling

Plan the Treatment of the Problem

1. Using Excel, setup and then reproduce the “base-case” financial analysis in the “Product Development Economics” chapter of the text
2. Perform a sensitivity analyses with respect to development cost, development time, and sales volume

Execute the Plan

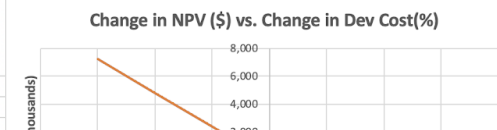
1. **Establish the cash flows, present and future associated with product development and commercialization**

<https://www.windowcentral.com/best-upgradeable-laptop>

2. Perform a sensitivity analyses with respect to development cost, development time, and sales volume

Sensitivity Analysis between NPV and Development Cost:

Base Dev Cost, \$	Change in Development	Development Cost, \$ Thousands	Change in Development Cost, \$ Thousands	NPV, \$ Thousands	Change in NPV, %	Change in NPV, \$ Thousands
25000	30%	32,500	7,500	111,501	-6.09%	-7,230
25000	20%	30,000	5,000	113,911	-4.06%	-4,820
25000	10%	27,500	2,500	116,321	-2.03%	-2,410



- By adding and subtracting 10%, 20% 30% to the development cost, we can see that with the percentage adding, the NPV shifts down. It is simple relationship, with more and more cost, the profit will decrease.

Sensitivity Analysis between NPV and Sales Volume:

- As we can see in the graph, with the sales volume increase, the NPV will also increase. It is clearly to see that, our company makes more revenue with more laptop sold. With each 10% more laptop sold in one quarter, the NPV changes 13%, which is \$15M more each quarter.

Section 3.5 Product Release Map

	2020	2021	2022	2023	
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Conclusions

Project Phase I

Before we did project phase 1, we assign a meeting and make a brainstorming about the topic we are going to do in this quarter. In Project Phase I, we design and analysis the firm strategy, including the overall competitive strategy, technology strategy and market strategy. After doing strategies, we did a Porter analysis and confirmed our position in the modular laptop industry. We did a lot of research on the Internet to identify our strategies and set up the industry analysis, we want to make the result to be correct and accurate. As a result, we set our company, ModiFi to be a new entrant company in the market, and our competitive strategy is product differentiation. ModiFi will maintain their competitive advantage by creating different and well-structured product to customers. In the Market strategy, we did a research of laptop market share, and our market share goal is 0.5% of whole laptop industry, which is reasonable and feasible for us. In Phase 1, our group did research and setup a goal for overall market performance of ModiFi, which connected to the work in phase 2 and phase 3.

Project Phase II

In Project Phase II, ModiFi began the development of the product by planning through an Activity Matrix, GANTT, Pert, and CPM charts. The activity matrix and Gantt chart would then model our tasks which would be completed on November 24, 2018 after completion of the product conceptual design. The Pert chart would then model and the CPM chart would evaluate the best “critical path” which would have the House of quality (HOQ) and Reverse engineering done in 3 - 4 weeks simultaneously. Based on the reverse engineering using a FAST diagram for similar products, ModiFi has realized that the expectations of the product would be a laptop. It was not until the HOQ and conceptual design was completed before realizing that the product would be completely new hence a “blue ocean strategy” which is development of a product in an uncontested market. This would then influence our Phase III (Product Platform/Line Strategy & Product Release Map).

Project Phase III

In Project Phase III, ModiFi started off by prototyping a laptop. This helped identify information in regards to core and supporting technology for our laptop. The information is then used in our product platform and line strategy. We used our prototype to create core and defining technology that makes our product unique. Furthermore, we created supporting elements that ensures our ModiFi laptop is fully functional. We then identified target market segments and decided to focus our product on everyday consumers first because it has a larger market, then Enterprise users. After that, we were able to identify the Risk Priority Number (RPN) after conducting a Failure Mode and Effect Analysis (FMEA) on our product. Last but not least, we generated an economic

and financial modeling of our product and performed analysis on costs, sales and net present value.

Guidelines

- Re-check work and add text to make the phases flow better like an actual project report being read by others who need guidance
- Understand that people who have no idea what the product is will be able to follow through the document with ease.

Individual Contributions

Group#: 22 Company: ModiFi Product: Modular Laptop					
Meeting date: 12/11/18					
Name	Proposal	Phase I	Phase II	Phase III	Phase IV
Qizhang Chen	<ul style="list-style-type: none"> - Six-forces analysis 	<ul style="list-style-type: none"> - Mission - Business Goals - Competitive analysis 	<ul style="list-style-type: none"> - FAST Diagram - Function Structure - Solution Principles 	<ul style="list-style-type: none"> - Revise Financial Modeling - FMEA with Eric 	<ul style="list-style-type: none"> - Table of content - Block Diagram - Conclusion for phase 1 - Slide #5 of PPT
Wan Fong	<ul style="list-style-type: none"> - Business Goals - Technology Strategy 	<ul style="list-style-type: none"> - Aggregate Project Plan - Potential Project Landscape 	<ul style="list-style-type: none"> - Convenient Scale for Technical Metrics - HOQ updated with technical metrics - HOQ Benchmarking - Selection Criteria - Utility Function 	<ul style="list-style-type: none"> - Product Platform Product Line Graph 	<ul style="list-style-type: none"> - Assisted Antoine with executive summary - Conclusion of presentation
Eric Hong	Recording of preliminary proposal Technology Strategy	Creating an aggregate projecting plan and appropriate R&D	Potential Development Projects Performing Decision analysis, Calculate EMV, and sensitivity analysis	Concept Rating Product Line and Platform (Market segment) FMEA	Conclusion for phase 3 Slide #4 of PPT
Caleb Jones	<ul style="list-style-type: none"> - Preliminary Competitive Strategy - Technology Strategy 	<ul style="list-style-type: none"> - Market sizing - Market needs analysis 	<ul style="list-style-type: none"> - Alternative concept generation 	<ul style="list-style-type: none"> - Product Platform/Product Line Strategy 	<ul style="list-style-type: none"> - Integration - Slide #2 (shared) of PPT

Antoine Rocha	<ul style="list-style-type: none"> - Competitive strategy - Porter -six forces analysis 	<ul style="list-style-type: none"> - Technology strategies - Preliminary risk analysis 	<ul style="list-style-type: none"> - House of quality - Reverse engineering 	<ul style="list-style-type: none"> - Prototyping strategy - Financial modeling 	<ul style="list-style-type: none"> - Integration executive summary/P prototyping strategy - Slide #4 competitive strategy
Yu Chen Shih	<ul style="list-style-type: none"> - Technology strategy 	<ul style="list-style-type: none"> - Aggregate project plan 	<ul style="list-style-type: none"> - Conceptual design 	<ul style="list-style-type: none"> - Product Release map 	<ul style="list-style-type: none"> - PPP Slide #2 - Integration Cross Reference
Monique Van	<ul style="list-style-type: none"> - “Time phased” project plan - Proposed Marketing strategy - Development Goals 	<ul style="list-style-type: none"> - Functional Maps of New Technologies/Products - Preliminary Risk Analysis - HOQ 	<ul style="list-style-type: none"> - Concept Utility Chart 	<ul style="list-style-type: none"> - Economic/ Financial Modeling 	<ul style="list-style-type: none"> - PPT presentation: Slide #2 - Reverse Engineering : Products