ISE 562: Decision Analysis

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Final Part 2

Case Study Report

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Team #2

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Executive Summary

The Daylight Alchemy Corporation (DAC) is at a critical juncture regarding the commercial future of its promising bio-engineered product, the Cyclone Enzyme. This enzyme shows significant potential for transforming waste into energy, appealing to both environmental and industrial sectors. Using the Decision Analysis (DA) Cycle framework - **Formulation, Evaluation, Appraisal, and Decide -** DA Corp. systematically navigates through the complexities of this decision.

Based on our analysis, the team recognizes No Partnership / No Expansion strategy could yield greater long-term value if the enzyme succeeds technically and commercially. Success in this path would not only lead to higher financial returns but also allow DAC to retain control over intellectual property, build core technical competencies, and position itself as an innovation leader.

Assumptions and Important notes

1. The company has an exponential U-curve.
2. Regarding the 4th alternative, the production capacity would be unlimited.
3. DA Corp. prioritizes profit making over fulfillment of demand.
4. DA Corp. complies with the 5 rules.
5. DA Corp. is risk averse.

Note: All NPV results and CE values are in units of millions.

Formulation Phase

Issue Raising

Raising issues during decision-making is crucial as it produces a more comprehensive and informed process, ultimately leading to better outcomes. By openly addressing concerns, decision makers can weigh various perspectives and ensure that the chosen decision taken for given, decisions need to be made now and in the future align with the desired goals and values.

Table 1: Issue Raising

No.	Issue	Type
1	Initial Year Demand Calculations	D
2	Current Capacity 2.5 Mil units	V
3	Expansion Capacity + 6 Mil units	V
4	Construction Cost for expansion	V
5	Demand for Cyclone	V, U
6	Production Capacity for cyclone	V, U
7	Loaning & expanding by themselves without partnerships	D
8	When to Start expansion	D
9	Going public for investors	D, O
10	Which company should market the product	D, U
11	Invest in R&D for better production ideas	D, U
12	Sell entire company and invest	D
13	Will the initial demand be higher or lower than what we predict?	U
14	Competition, market price	U, O
15	Pandemic possibility	U, O
16	Rent the depreciating assets	D, U
17	Renting production plans	D, U
18	Partnering with relevant companies	D, O
19	Partnering with marketing Agency	D, O
20	Partnering with international companies (Cheap labor)	D, O
21	Outsourcing raw materials for the enzyme	D
22	Selling the company and receiving royalty for every good sold	D
23	Is EnzyTech's proposal a yearly contract?	U
24	Is the discount rate constant or can it change?	U
25	Should we run a discounted cash flow analysis for construction cost?	D
26	Who should market in the initial year?	D
27	Should we expand?	D, U
28	Which strategy to go with?	D
29	What is the basis of "Which strategy to select?" (Profit, matching demand, etc.)	D, U

Decisions:

1. Initial Year Demand Calculations
2. Loaning & expanding by themselves without partnerships
3. When to Start expansion
4. Going public for investors
5. Which company should market the product
6. Invest in R&D for better production ideas
7. Sell entire company and invest
8. Rent the depreciating assets.
9. Renting production plans
10. Partnering with relevant companies
11. Partnering with marketing Agency
12. Partnering with international companies (Cheap labour)
13. Outsourcing raw materials for the enzyme
14. Selling the company and receiving royalty for every good sold
15. Should we run a discounted cash flow analysis for construction cost?
16. Who should market in initial year?
17. Should we expand?
18. Which strategy to go with?
19. What is the basis of "Which strategy to select?" (Profit, matching demand, etc.)

Uncertainties:

1. Demand for Cyclone
2. Production Capacity for cyclone
3. Which company should market the product
4. Invest in R&D for better production ideas
5. Will the initial demand be higher or lower than what we predict?
6. Competition, market price
7. Pandemic possibility
8. Rent the depreciating assets.
9. Renting production plans
10. Is the EnzyTech's proposal a yearly contract?
11. Is the discount rate constant or can it change?
12. Should we expand?
13. What is the basis of "Which strategy to select?" (Profit, matching demand, etc.)

Values:

1. Current Capacity 2.5 Mil units

2. Expansion Capacity + 6 Mil units
3. Construction Cost for expansion
4. Demand for Cyclone
5. Production Capacity for cyclone

Other:

1. Going public for investors
2. Competition, market price
3. Pandemic possibility
4. Partnering with relevant companies
5. Partnering with marketing Agency
6. Partnering with international companies (Cheap labour)

Decision Hierarchy

After discussing the issues, we took into consideration the decisions that are taken as given, in this case, we consider that DA Corp. prioritizes profit making over fulfillment of demand. Some Key decisions needed to be made are listed in the center of the hierarchical diagram and finally, future decisions based on the outcomes are listed at the bottom.

Priorities of DA Corp.?
1. Profit Making
2. Demand fulffiling

1. Should we expand?
2. Which company should market the product
3. Initial Year Demand Calculations
4. What does the future look like for DA Corp.

1. When to Start expansion
2. Outsourcing raw materials for the enzyme
3. Who should market in initial year?

Figure 1: Decision Hierarchy

Strategy Table

Conducting a Strategy Table allows us to provide clarity on several options of high-level strategic decisions that will be made for DA Corp. Furthermore, it gives us different options for each strategic decision. This will ultimately help the company decide on which decision to take based on the different options it comes with. As well as plan on when to execute each decision with enough information on which option to take.

We consider 3 kinds of strategy based on how we feel about the uncertainties that will occur:

1. Optimistic: This strategy allows us to operate on a high demand, high growth rate with higher Unit Revenue.

2. Moderate: This strategy explores the Base considerations of Demand, Growth Rate and Unit Revenue.

3. Pessimistic: This strategy allows DA Corp. to operate on lower demand and growth rate and to consider a joint venture with EnzyTech to fulfill corporation goals.

Table 2: Strategy Table

Strategic Decisions for DA Corp				
Strategy	Expansion	Marketing Company	Initial Year Demand & Growth Rate	Future Plans
1. Optimistic: & 2. Moderate: * 3. Pessimistic: --	Expand with Joint Venture (*) Expand with Royalty Partnership (--) Expand without partnership (&)	DA Corp will be responsible for marketing. (&) EnzyTech will handle the marketing as a joint venture or a royalty contract. (*,--)	High Demand (D), High Growth Rate (GR). (&) High D, Base/Low GR. (*) Low D, Base/Low GR. (*, --) Low D, Low GR. (--)	Reinvest and growth Sell off to partners. Sell majority and keep shares/royalty.

Decision Diagram

DA Corp. must make decisions around:

1. **Production Expansion** (2.5M → 8.5M units/year)
2. **Commercialization Strategy**:
    a. Market Cyclone in-house (Future decision)
    b. Partner with **EnzyTech** via:
        i. **Joint Venture** (40% profit share to DA Corp.)
        ii. **Royalty Agreement** (2% of sales revenue to DA Corp.)
- Strategic Implications
1. Expansion Decision

The strategy requires confidence in high demand, growth rate, and unit revenue. The risks associated with the strategy are that the expansion is costly and irreversible. If demand underwhelms or costs rise, it could lead to sunk costs and underused capacity.

2. Joint Venture vs. Royalty

Joint Venture is preferred when EnzyTech's marketing multiplier is high, revenue is high and costs are low (higher margins to share). DA Corp. must be willing to take on market risk for higher long-term returns. On the other hand, Royalty Contract is preferred when costs are unpredictable or high, market uncertainty is high and DA Corp. seeks low risk returns. It should be noted that EnzyTech marketing delivers scale but DA Corp. wants simplicity.

3. In-House Marketing

This strategy offers full control but it is limited by existing capacity unless DA Corp. Expands. There is more risk due to limited marketing experience and the strategy may only be viable if demand is moderate and DA Corp. wants to retain all profits.

In conclusion, DA Corp. should weigh each uncertainty carefully before committing to a path. Uncertainties like market size (demand + multiplier), unit economics (revenue vs. cost), and long-term growth will shape whether it's best to expand and market alone, partner via a Joint Venture, or License Cyclone for royalties.
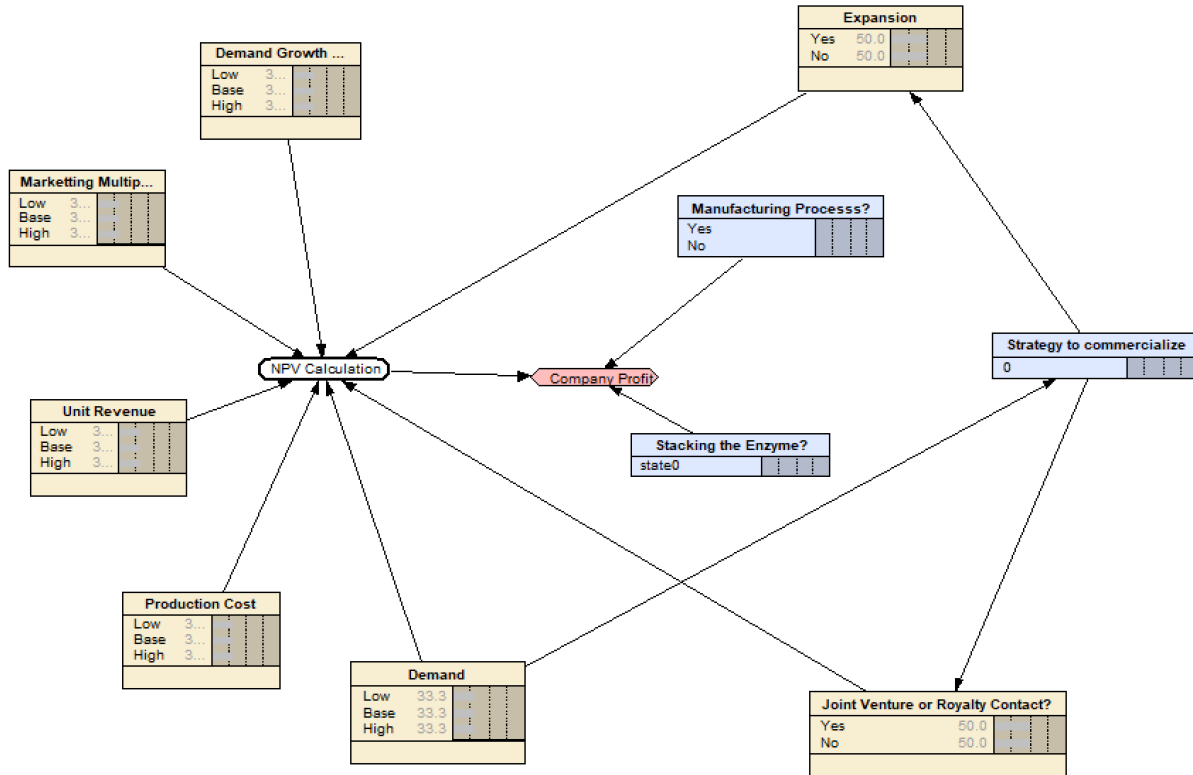
Figure 2: Decision Diagram

Note: The limited license of Netica allows only 15 node-tree to be saved. Thus, the remaining Decision Tree is pasted in the Appendix.

Evaluate Phase

Spreadsheet Models

Using Excel, we were able to able to create a model that calculates the net present value for each of the 4 alternatives based on the given data and uncertainties. Figure 3 calculates the net present value for alternative 1 based on the base values from each of the uncertainties. We have also included the base calculations for each of the 4 alternatives in the appendix. The NPV model will be used to determine the necessary values needed in the upcoming sections of the report.

Daylight Alchemy Corporation's Value Model

Section 1 - Strategy Selection

Strategy	1	strategy
Strategy Name	No Partnership / No Expansion	strategy_name

Strategy Descriptions
  1 No Partnership / No Expansion
  2 No Partnership / Expansion
  3 Joint Venture
  4 Royalty

Here you can select the alternative that you want. Just enter the appropriate number. The cell that contains this number is called "strategy".

Section 2 - Constants

Description	Units	Value	Name
Real discount rate	%	8%	discount_rate
Tax Rate	%	38%	tax_rate
JV share	%	60%	JV_share
RP share	%	98%	RP_share

Section 3 - Uncertainties

Description	Units	Index	In Use	Name	Low	Base	High
Demand uncertainties							
DA Corp. markets	million units/year	2	2.5	dem_DAC	1.0	2.5	5.5
EnzyTech Multiple	million units/year	2	1.6	Enz_M	1.3	1.6	1.8
Demand Growth Rate	% / year	2	0.1	DGR	-5%	7%	9%
Costs uncertainties							
Unit Revenue	$ / unit	2	10.8	UR	9.75	10.75	11.50
Production cost	$ / unit	2	9.5	PC	9.25	9.50	9.75
Plant Construction Cost	$ million	2	14.5	PCC	13.0	14.5	17.0

Section 4 - Calculations

No Partnership / No Expansion

Year		2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period		0	1	2	3	4	5	6	7	8	9
Sales											
Demand | DA Corp. Markets	MM units	2.50	2.68	2.86	3.06	3.28	3.51	3.75	4.01	4.30	4.60
Demand | EnzyTech Markets	MM units	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Capacity	MM units	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Sales	MM units	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Revenue	MM $	26.88	26.88	26.88	26.88	26.88	26.88	26.88	26.88	26.88	26.88
Production Cost	MM $	23.75	23.75	23.75	23.75	23.75	23.75	23.75	23.75	23.75	23.75
Plant Cost	MM $	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JV Payment	MM $	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Royalty Payment	MM $	26.34	26.34	26.34	26.34	26.34	26.34	26.34	26.34	26.34	26.34
Earnings Before Tax	MM $	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13
Taxes	MM $	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19
Tax Credit Available for Next Year	MM $	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tax Payment	MM $	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19
Cash Flow	MM$	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94
Present Equivalent	MM 2026 $	$ 14.04									

Figure 3: NPV model for Alt. 1

Deterministic Sensitivity

Using the NPV models, we were able to obtain the following tables for each of the alternatives:

Table 3: No Partnership / No Expansion

	NPV			Max Swing		
Uncertainty	Low	Base	High	D	D^2	D^2/Sum
Demand Growth Rate	$ 11.63	$ 14.04	$ 14.04	$ 2.41	$ 5.80	1.24%
Production cost	$ 16.85	$ 14.04	$ 11.23	$ 5.62	$ 31.54	6.75%
DA Corp. markets	$ 7.43	$ 14.04	$ 14.04	$ 6.61	$ 43.64	9.34%
Unit Revenue	$ 2.81	$ 14.04	$ 22.47	$ 19.66	$ 386.40	82.67%

Table 4: No Partnership / Expansion

	NPV			Max Swing		
Uncertainty	Low	Base	High	D	D^2	D^2/Sum
Plant Construction Cost	$ 10.01	$ 8.95	$ 7.14	$ 2.86	$ 8.20	0.39%
Production cost	$ 12.78	$ 8.95	$ 5.06	$ 7.71	$ 59.49	2.83%
Demand Growth Rate	$ 1.90	$ 8.95	$ 10.58	$ 8.68	$ 75.37	3.58%
Unit Revenue	$ (8.50)	$ 8.95	$ 20.37	$ 28.88	$ 833.95	39.66%
DA Corp. markets	$ (3.04)	$ 8.95	$ 30.51	$ 33.55	$1,125.60	53.53%

Table 5: Joint Venture

	NPV			Max Swing		
Uncertainty	Low	Base	High	D	D^2	D^2/Sum
EnzyTech Multiple	$ 9.67	$ 11.90	$ 13.38	$ 3.72	$ 13.82	2.52%
Production cost	$ 14.28	$ 11.90	$ 9.52	$ 4.76	$ 22.64	4.12%
Demand Growth Rate	$ 7.44	$ 11.90	$ 12.90	$ 5.46	$ 29.77	5.42%
DA Corp. markets	$ 4.76	$ 11.90	$ 19.10	$ 14.34	$ 205.56	37.43%
Unit Revenue	$ 2.38	$ 11.90	$ 19.03	$ 16.65	$ 277.36	50.51%

Table 6: Royalty

	NPV			Max Swing		
Uncertainty	Low	Base	High	D	D^2	D^2/Sum
Unit Revenue	$ 4.64	$ 5.12	$ 5.47	$ 0.83	$ 0.69	0.74%
EnzyTech Multiple	$ 4.16	$ 5.12	$ 5.75	$ 1.60	$ 2.56	2.73%
Demand Growth Rate	$ 3.20	$ 5.12	$ 5.56	$ 2.36	$ 5.56	5.94%
DA Corp. markets	$ 2.05	$ 5.12	$ 11.25	$ 9.21	$ 84.78	90.58%

Using a threshold of <5%, we were able to determine the uncertainties that have the least impact on the NPV model for each of the 4 alternatives. This information will allow us to reduce the number of prospects when creating the decision trees.

Tornado Diagrams

Using the tables obtained from the previous section, we were able to construct the following tornado diagrams for each of the alternatives:
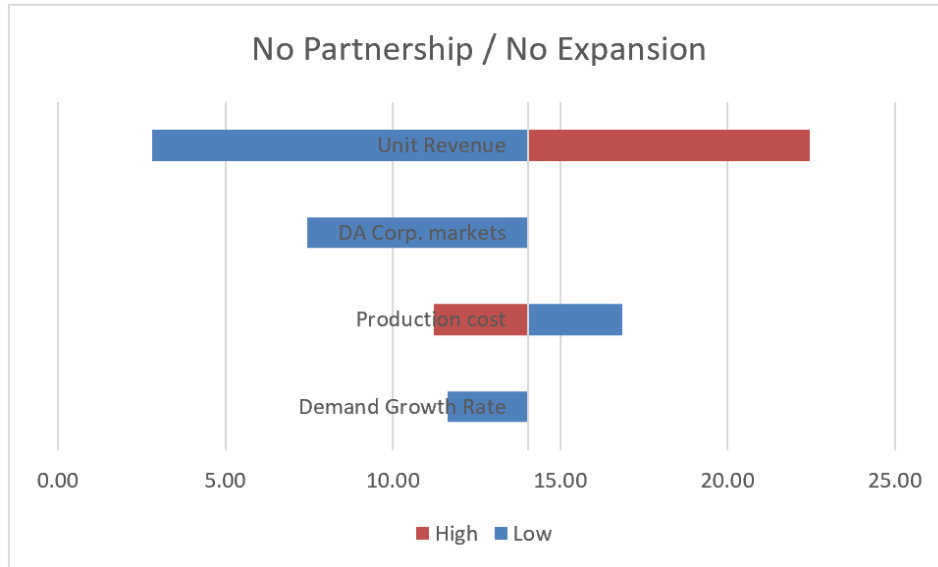

Figure 4: No Partnership / No Expansion
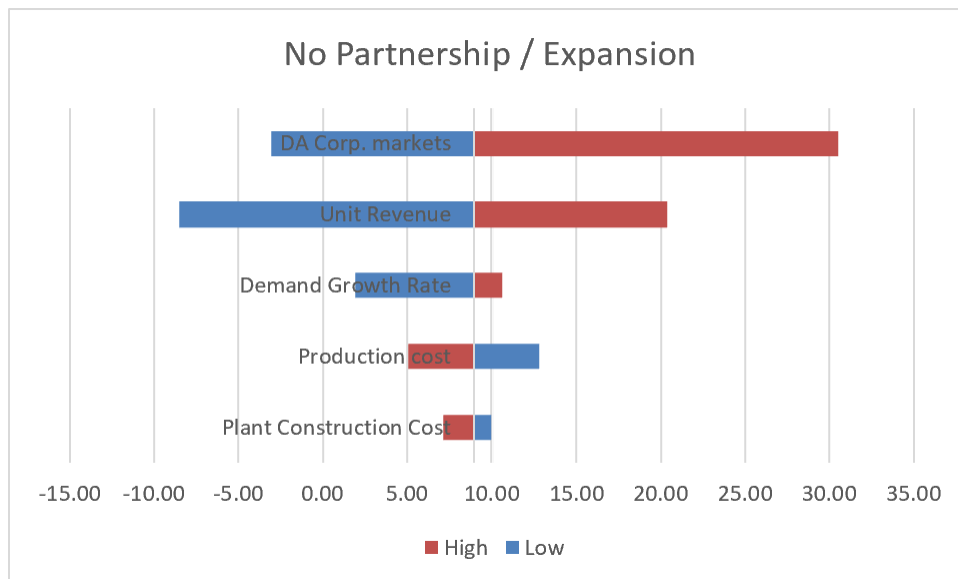
Figure 5: No Partnership / Expansion

Figure 6: Joint Venture

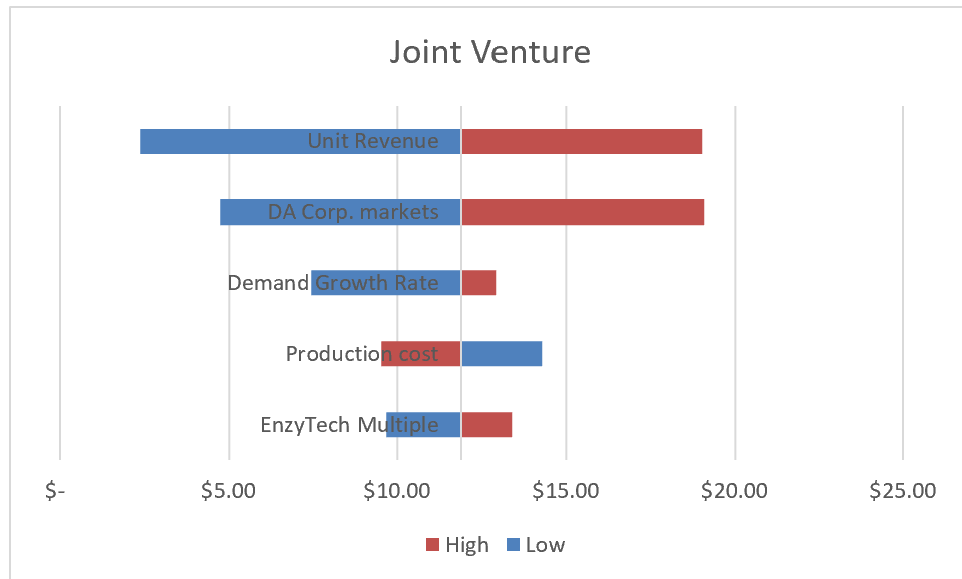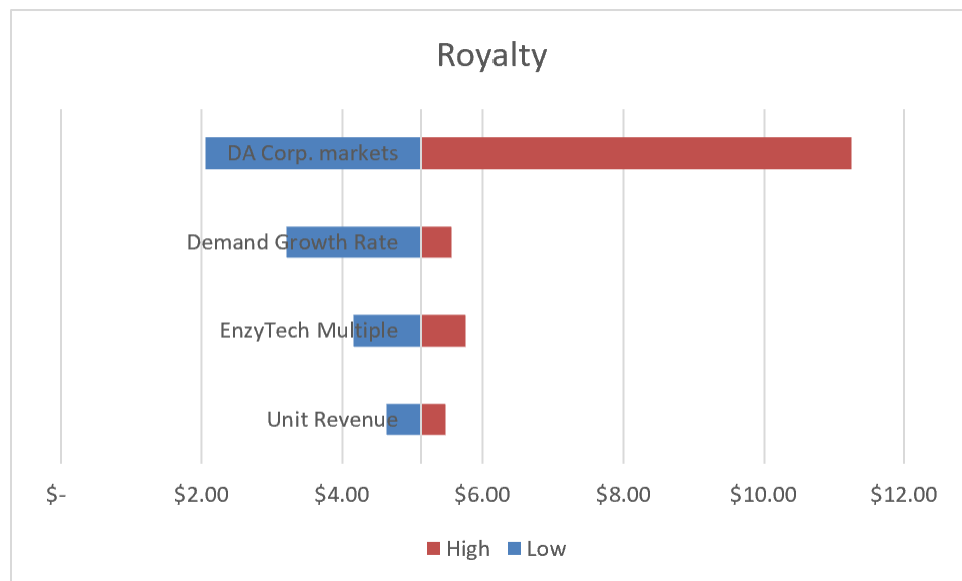Figure 7: Royalty

The tornado diagrams help us determine by visual inspection the uncertainties with the most impact on our NPV model for each alternative starting from the least impactful at the bottom to the most at the top. As we can see, the impact of each uncertainty varies based on the alternative. However, two of the most impactful uncertainties are DA Corp. markets and the unit revenue.

Decision trees and certain equivalent

Using the results obtained from the deterministic sensitivity and the tornado diagrams, we were able to reduce the number of prospects by setting the uncertainties that have a D^2/sum value of less than 5% to their base value. In addition, by using the following utility function of $U(x) = 1 - e^{-x(\gamma)}$ and the given risk tolerance value of $30 million, we were able to calculate the U-value for each of the prospects based on their x value which in this case was the NPV value associated with each prospect. Figure 28, that is in the appendix of this report, represents the decision tree that was used to obtain the following results:

Table 7: Certain Equivalent

Results	
Alternative	CE
No Partnership / No Expansion	$ 10.94
No Partnership / Expansion	$ 5.64
Joint Venture	$ 9.68
Royalty	$ 5.28

Table 8: Best alternative

Max CE	Alternative
$ 10.94 million	No Partnership / No Expansion

As we can from table 8, the alternative that has the highest certain equivalent, and the one that we recommend Daylight Alchemy Corporation should go with is the No Partnership / No Expansion alternative.

High, base, low of probability distributions

Using the cumulative probability distributions given in the case study, we wanted to determine the High, base, low values for each uncertainty using the shortcut of the equal areas method. Our team wanted to compare the values obtained from this method to the values given in the case study. Using this method, we have obtained the results shown in table 9.

Table 9: High, base, low values

	Low	Base	High
Demand uncertainties			
DA Corp. markets	0.95	2.75	5.4
EnzyTech Multiple	1.14	1.61	2.05
Demand Growth Rate	-3.2%	3.6%	10.8%
Costs uncertainties			
Unit Revenue	9.95	10.7	11.4
Production cost	9.24	9.48	9.7
Plant Construction Cost	13.6	14.8	16.15

After obtaining these values, we wanted to determine if using these values would provide us with different results compared to the values provided in the case study. Next, we used the new values for the DA Corp. markets uncertainty and replaced them in our model in order to calculate the certain equivalent and to observe if there are any differences. This uncertainty was chosen because it is one of the most impactful uncertainties in all 4 alternatives. The tables below show our results. We can conclude based on the results that using the new values would not provide us with different findings and conclusions compared to using the given values aside from negligible differences in the CE values. Based on that, our team has decided to conduct our analysis using the values given in the case study.

Table 10: New results

Results	
Alternative	CE
No Partnership / No Expansion	$10.84
No Partnership / Expansion	$6.22
Joint Venture	$10.05
Royalty	$5.45

Table 11: New CE

Max CE	Alternative
$ 10.84 million	No Partnership / No Expansion

Stochastic Dominance Analysis

Conducting the dominance analysis as considering the 4 strategies to be 4 different deals, we were able to determine which strategy is better than the other based on the cumulative distribution functions of the NPV values of different prospects in each strategy.

We divided the distribution of NPV ranging from -$27.00 to $55.00 in increments of $0.01.

Strategy 1 – No Partnership / No Expansion

Strategy 2 – No Partnership with Expansion

Strategy 3 – Joint Venture with EnzyTech

Strategy 4 – Royalty Contract with EnzyTech

The Probability Mass Functions:
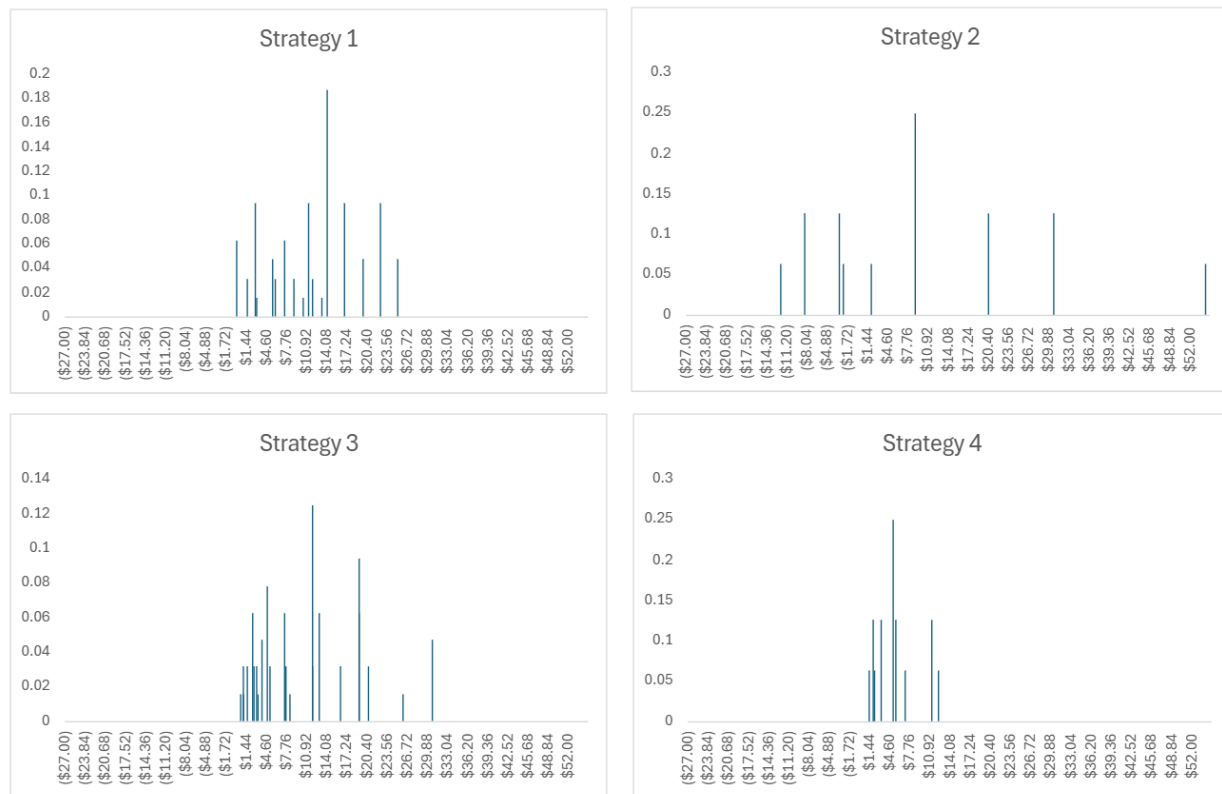
Figure 8: Probability Mass Functions of each Strategy

The Cumulative Distribution functions:
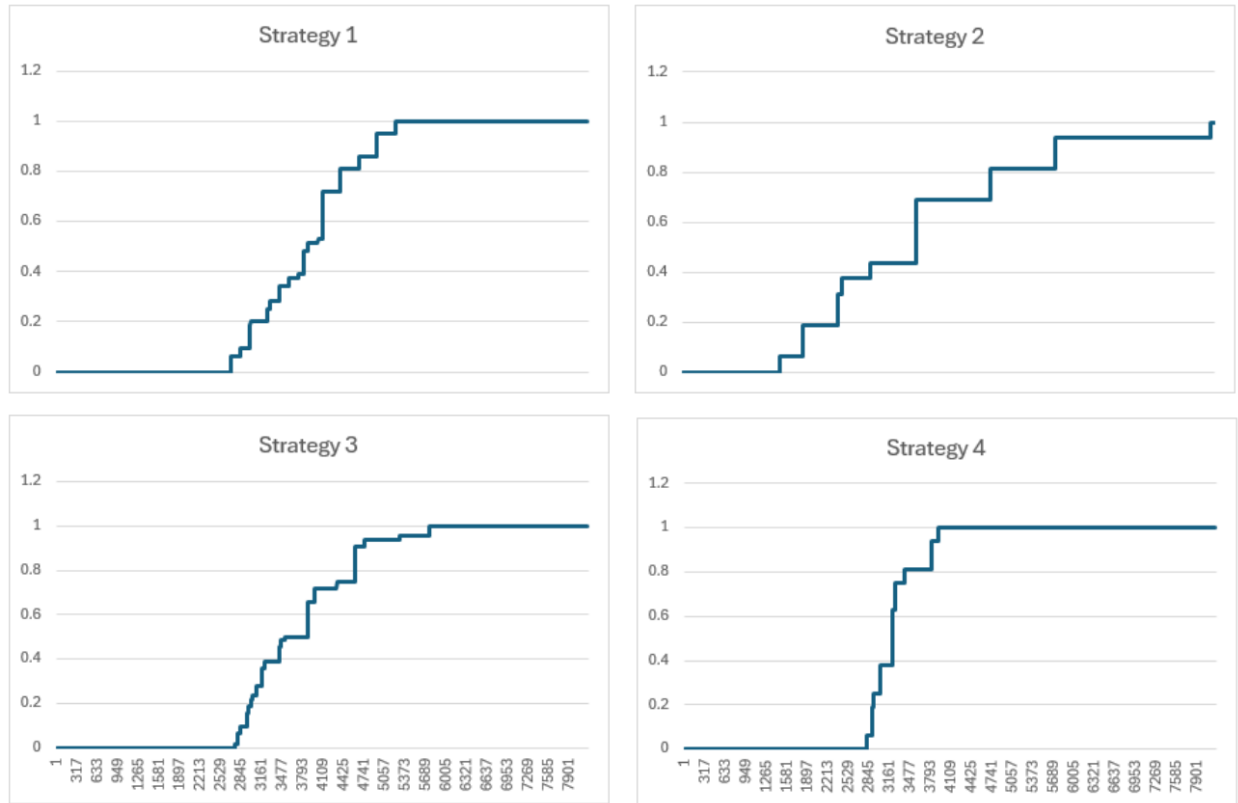
Figure 9: Cumulative Probability Functions of each Strategy
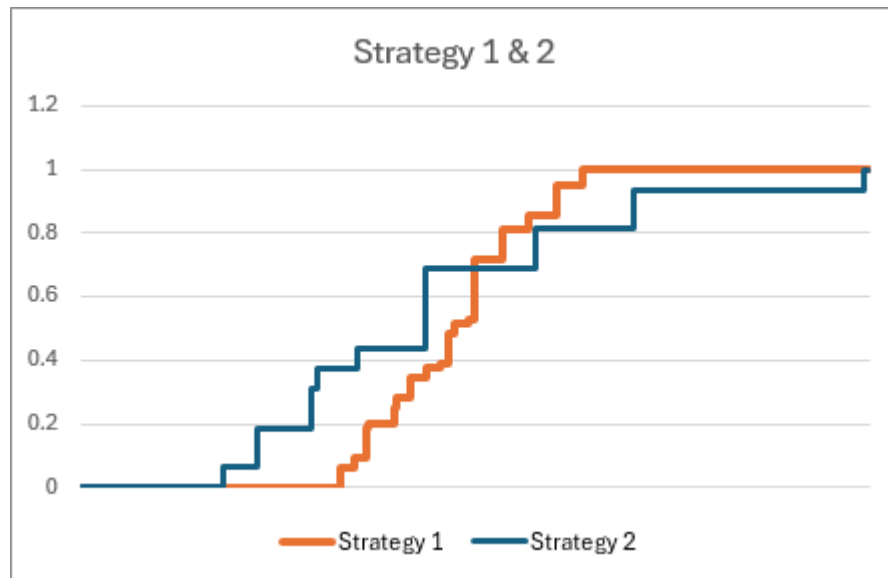
Figure 10: Comparison of Strategy 1 & 2
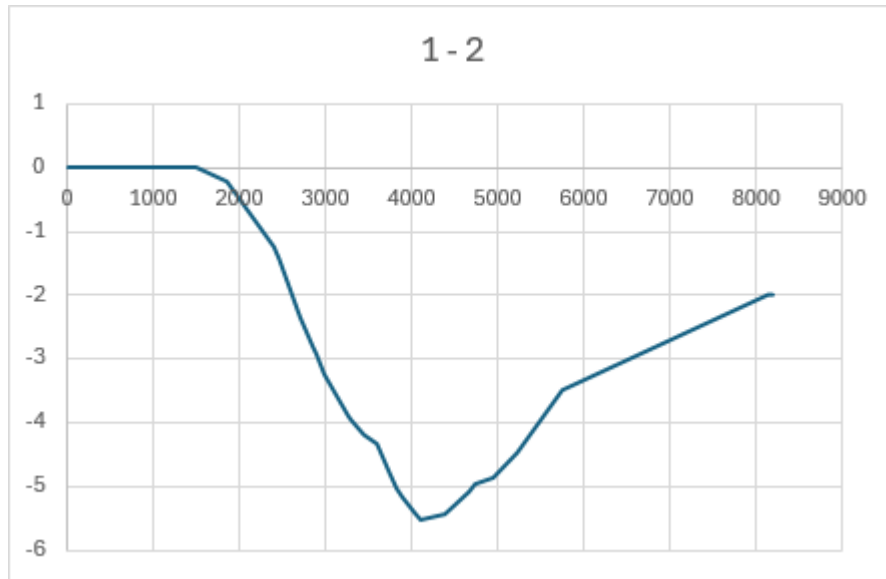
Figure 11: First Order Dominance of Strategy 1 over Strategy 2.

Figure 12: Comparison of Strategy 2 & 3
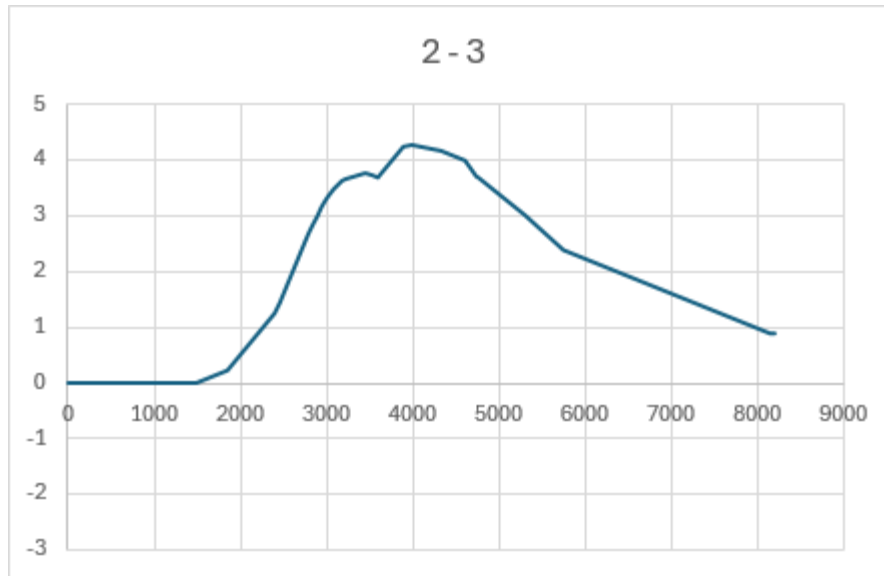
Figure 13: First Order Dominance of Strategy 3 over Strategy 2.
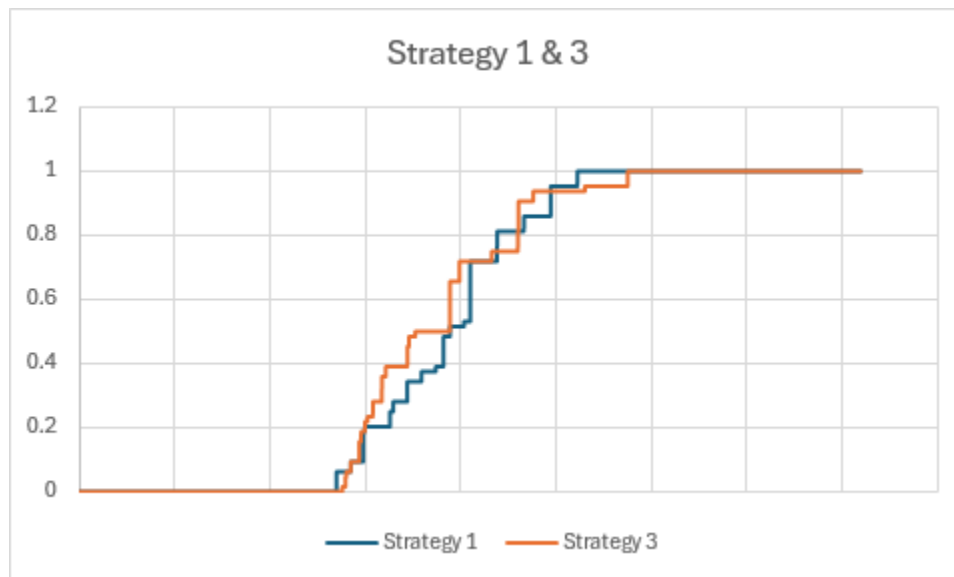
Figure 14: Comparison of Strategy 1 & 3:
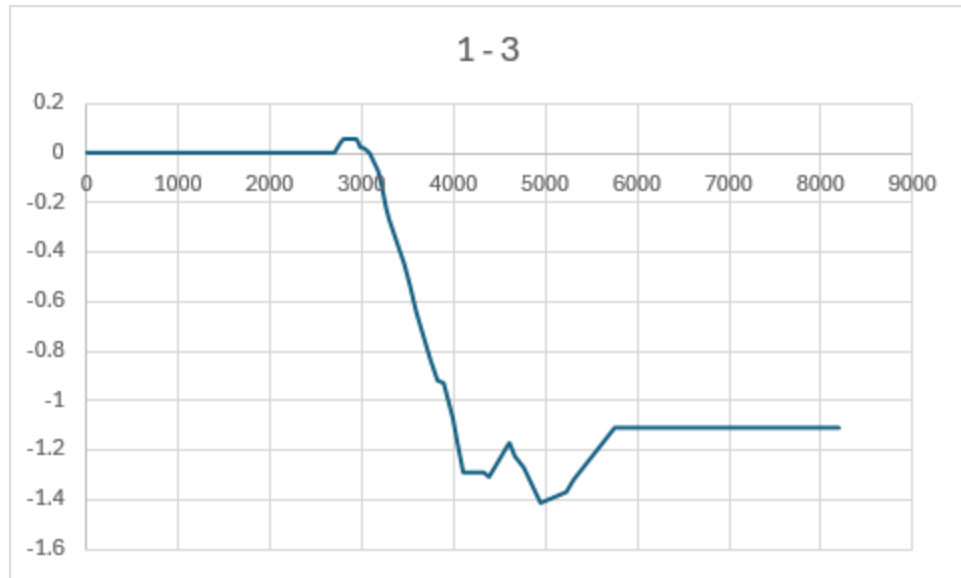
Figure 15: First Order Diagram for Strategy 1 and Strategy 3.
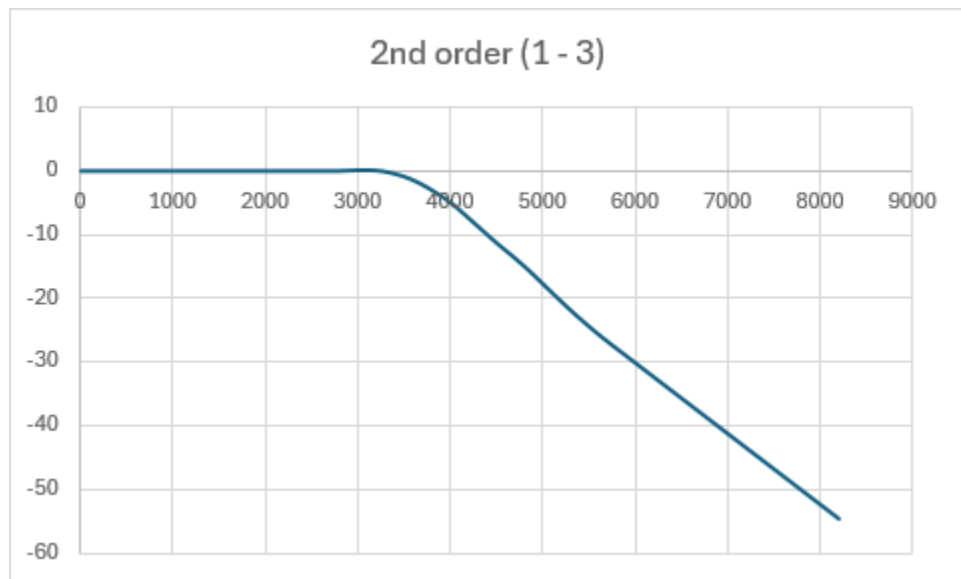
Figure 16: Second Order Dominance of Strategy 1 over Strategy 3.

And finally,

Figure 17: Comparison of Strategy 3 & 4:
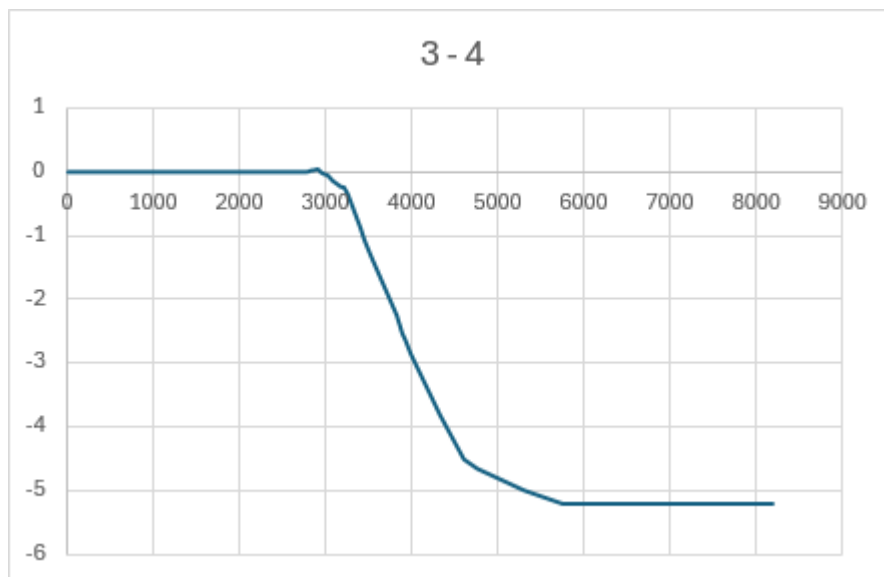
Figure 18: First Order Diagram for Strategy 3 and Strategy 4.
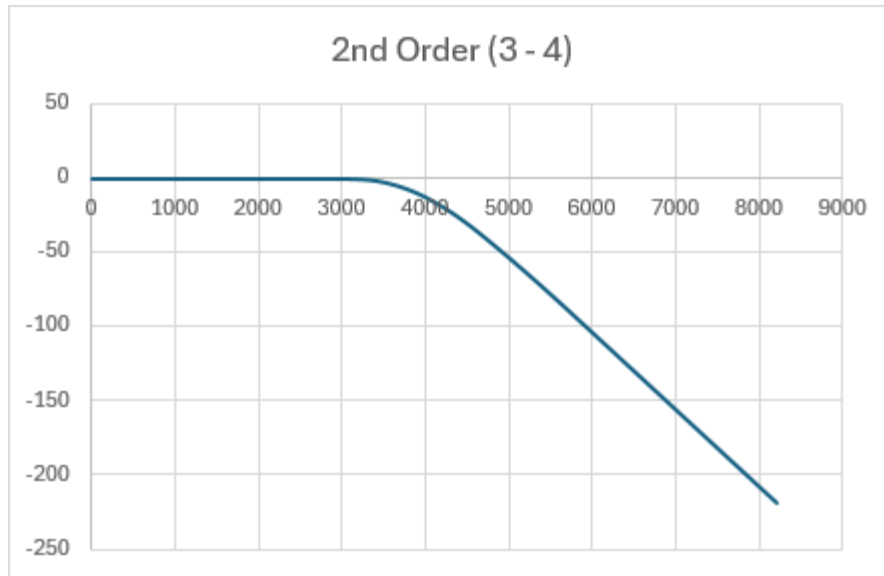
Figure 19: Second Order Dominance of Strategy 3 over Strategy 4.

Concluding the dominance analysis, we can rank the strategies as:

Strategy 1 > Strategy 3 > Strategy 2, Strategy 4

Thus, the alternative that has the highest probabilistic dominance and the one that we recommend Daylight Alchemy Corporation should go with is the **No Partnership / No Expansion** alternative.

Appraisal Phase

Sensitivity Analysis

Our team also wanted to conduct a sensitivity analysis to observe the impact of changing various factors in our model, and how the best alternative will be affected in doing so. The first analysis that we did was based on the certain equivalent versus the risk aversion coefficient. Table 12 and figure 20 represent our results.

Table 12: certain equivalent vs. Gamma

Gamma	Max CE	Alternative
-1	$ 51.69	No Partnership / Expansion
-0.9	$ 51.38	No Partnership / Expansion
-0.8	$ 51.00	No Partnership / Expansion
-0.7	$ 50.50	No Partnership / Expansion
-0.6	$ 49.84	No Partnership / Expansion
-0.5	$ 48.92	No Partnership / Expansion
-0.4	$ 47.53	No Partnership / Expansion
-0.3	$ 45.23	No Partnership / Expansion
-0.2	$ 40.70	No Partnership / Expansion
-0.1	$ 29.44	No Partnership / Expansion
0	$ 11.77	No Partnership / No Expansion
0.1	$ 9.38	No Partnership / No Expansion
0.2	$ 7.47	No Partnership / No Expansion
0.3	$ 6.09	No Partnership / No Expansion
0.4	$ 5.11	No Partnership / No Expansion
0.5	$ 4.40	No Partnership / No Expansion
0.6	$ 4.00	Joint Venture
0.7	$ 3.70	Joint Venture
0.8	$ 3.46	Joint Venture
0.9	$ 3.26	Joint Venture
1	$ 3.09	Joint Venture

CE vs Risk Aversion Coefficient
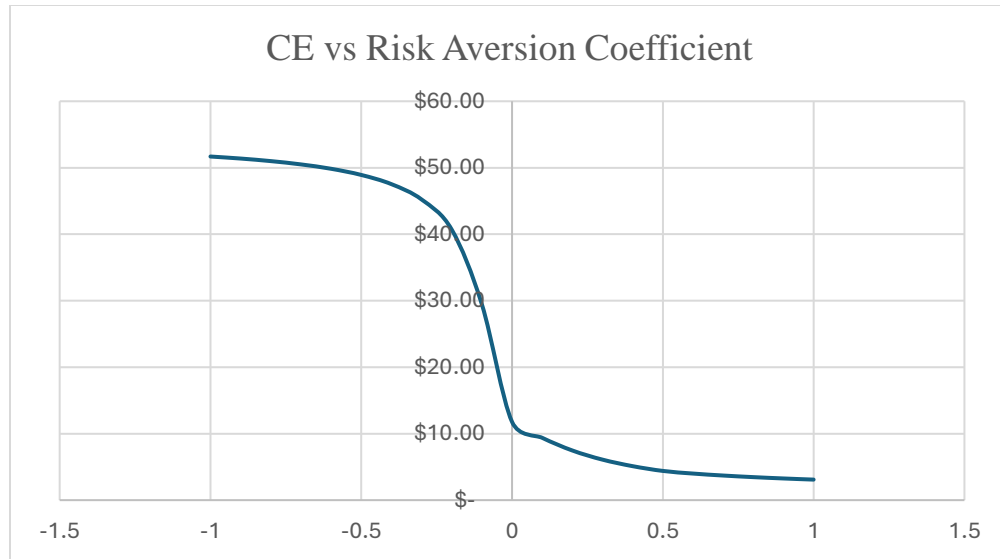
Figure 20: certain equivalent vs. Gamma

As we can see, as long as Daylight Alchemy Corporation remain risk averse, the best alternative would vary based on their risk aversion coefficient. On the other hand, if they become risk neutral, the best alternative would be No Partnership / No Expansion. Lastly, if they become risk seeking, then the best alternative would be No Partnership / Expansion.

The second analysis that we did was based on the discount rate percentage. For our analysis, we calculated the CE value for the ranges of 5%-50%. The table and figure below represent our results. We can conclude based on the results that changing the discount rate will have no effect on the best alternative, however, it will impact the value of the certain equivalent.

Table 13: CE vs. Discount Rate

Discount Rate	Max CE	Alternative
5%	$ 12.16	No Partnership / No Expansion
10%	$ 10.23	No Partnership / No Expansion
15%	$ 8.79	No Partnership / No Expansion
20%	$ 7.70	No Partnership / No Expansion
25%	$ 6.85	No Partnership / No Expansion
30%	$ 6.18	No Partnership / No Expansion
35%	$ 5.64	No Partnership / No Expansion
40%	$ 5.21	No Partnership / No Expansion
45%	$ 4.85	No Partnership / No Expansion
50%	$ 4.55	No Partnership / No Expansion
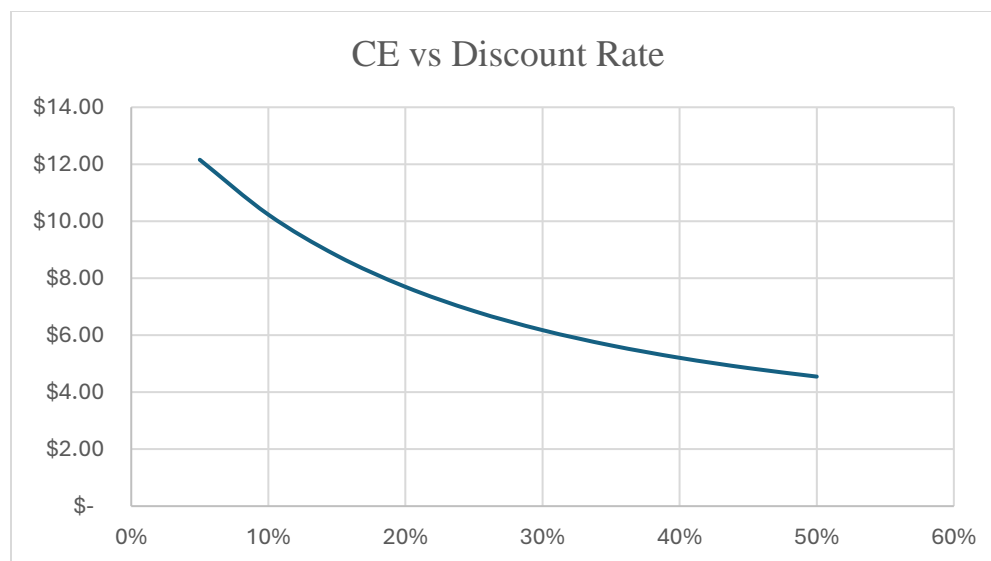
CE vs Discount Rate

Figure 21: CE vs. Discount Rate

For our next analysis, we wanted to determine the impact of the tax rate on the certain equivalent. To determine the best range for the tax rate, we looked at the lowest and highest tax rate values from the past 116 years, and according to the trading economics website, the highest tax rate was 52.8%, while the lowest tax rate was 1%. The table and figure below display our findings. Based on our analysis, we can conclude that changing the tax rate will not impact the best alternative, but it will impact the certain equivalent value.

Table 14: CE vs. Tax Rate

Tax Rate	Max CE	Alternative
5%	$ 16.09	No Partnership / No Expansion
10%	$ 15.34	No Partnership / No Expansion
15%	$ 14.58	No Partnership / No Expansion
20%	$ 13.80	No Partnership / No Expansion
25%	$ 13.02	No Partnership / No Expansion
30%	$ 12.23	No Partnership / No Expansion
35%	$ 11.42	No Partnership / No Expansion
40%	$ 10.61	No Partnership / No Expansion
45%	$ 9.78	No Partnership / No Expansion
50%	$ 8.95	No Partnership / No Expansion
55%	$ 8.10	No Partnership / No Expansion
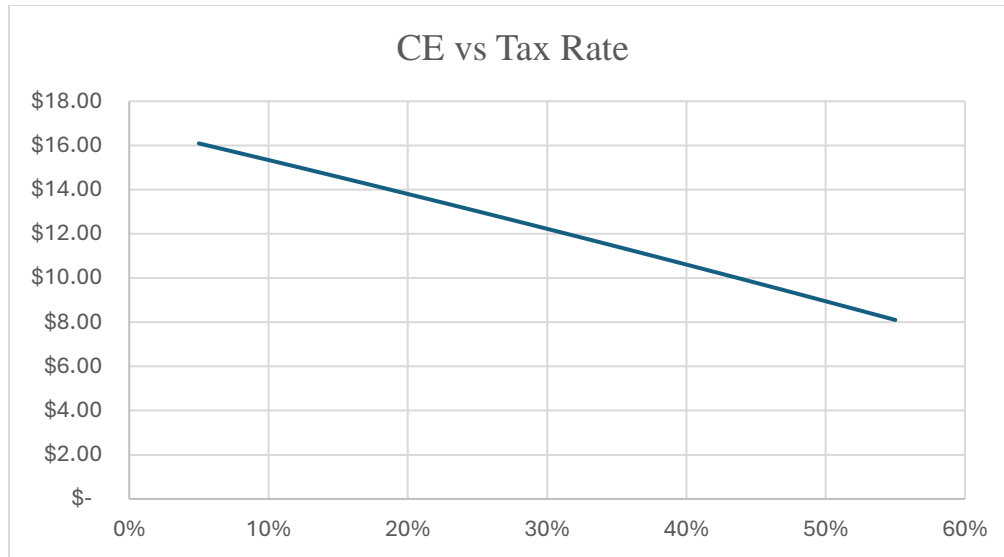
CE vs Tax Rate

Figure 22: CE vs. Tax Rate

Lastly, our team wanted to analyze the impact of changing the royalty payment percentage of the 4th alternative on the certain equivalent. Using a range of 85%-98% for the RP share, we obtained the results shown below. As we can see, depending on the percentage, not only does the certain equivalent change, but so does the best alternative. If the RP share percentage can be negotiated to be less than or equal to 95%, then the best alternative would be the royalty alternative.

Table 15: CE vs. RP Share

RP share	Max CE	Alternative
85%	$ 32.88	Royalty
86%	$ 31.07	Royalty
87%	$ 29.22	Royalty
88%	$ 27.32	Royalty
89%	$ 25.38	Royalty
90%	$ 23.39	Royalty
91%	$ 21.35	Royalty
92%	$ 19.25	Royalty
93%	$ 17.09	Royalty
94%	$ 14.87	Royalty
95%	$ 12.59	Royalty
96%	$ 10.94	No Partnership / No Expansion
97%	$ 10.94	No Partnership / No Expansion
98%	$ 10.94	No Partnership / No Expansion
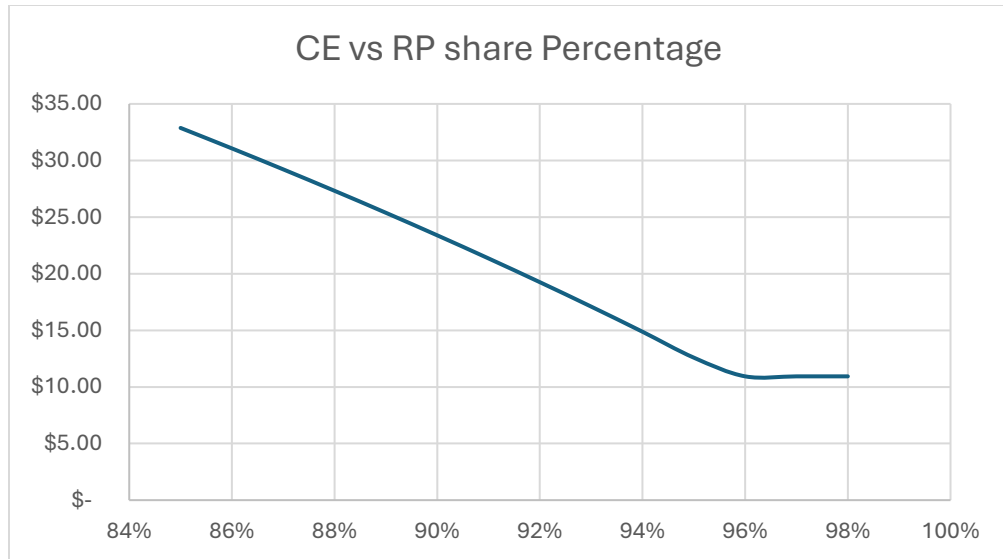
Figure 23: CE vs. RP Share

Final Remarks for the Second Iteration of our Decision Analysis

Prior to starting the next iteration, our team would like to ask DA Corp. the following questions:

1. Have they considered all the possible alternatives that may affect their decisions?
2. Have they considered all the possible uncertainties that go into their decisions?
3. Can DA Corp. negotiate with EnzyTech regarding the royalty payment percentage?

For the next iteration, our team would also like to test the assumption that is in regard to the production capacity of the 4th alternative.

Lastly, our team would like to suggest the following:

1. As a new alternative, DA corp. could consider the idea of renting additional facilities that could be used to increase production capacity.
2. DA Corp. could also consider other potential candidates aside from EnzyTech in case there are better deals that can be made.

Elements of Ethical Decision Quality

When it comes to the 11 elements of Ethical Decision Quality, our team wanted to determine If any of them are present in this case study. We wanted to observe how it may have impacted the decisions of DA Corp. if they were present. After going over the case study, our team has determined that the following element may be present. The element that we would like to discuss is the alternatives element. After doing some brainstorming, and looking at the situation from an unbiased perspective, we believe that DA Corp. may have unintentionally limited the number of alternatives that they can proceed with. In doing so, they may have missed many great opportunities that could greatly affect profit and the company in general.

Recommendations

After conducting several tools, tests and analysis we have gathered sufficient information to recommend an alternative for DA Corp. After obtaining the certain equivalence of each deal, we found that the maximum certain equivalence of all the deals was for the deal of no expansion and no partnership at $10.94 million. With that being said, our final recommendation for DA Corp is to proceed with the deal of no partnership and no expansion.

The sensitivity analysis indeed backed our recommendation but also provided us with slight scenarios where DA Corp should change their course of action. We found that if the RP share was between 85% and 95%, then DA Corp should expand with Royalty. Also, if the risk aversion coefficient is between 0.6 and 1, then the Joint venture deal is the best option due to having a higher certain equivalence.

All in all, our research provided us with sufficient information to recommend DA Corp with a no expansion and no partnership deal, with a few caveats that DA Corp must be aware of before taking the deal.

References

1- https://tradingeconomics.com/united-states/corporate-tax-rate#:~:text=The%20Corporate%20Tax%20Rate%20in,source%3A%20Internal%20Revenue%20Service

Appendix

Daylight Alchemy Corporation's Value Model

Section 1 - Strategy Selection

Strategy	1	strategy
Strategy Name	No Partnership / No Expansion	strategy_name

Strategy Descriptions
1 No Partnership / No Expansion
2 No Partnership / Expansion
3 Joint Venture
4 Royalty

Here you can select the alternative that you want. Just enter the appropriate number. The cell that contains this number is called "strategy".

Section 2 - Constants

Description	Units	Value	Name
Real discount rate	%	8%	discount_rate
Tax Rate	%	38%	tax_rate
JV share	%	60%	JV_share
RP share	%	98%	RP_share

Section 3 - Uncertainties

Description	Units	Index	In Use	Name	Low	Base	High
Demand uncertainties							
DA Corp. markets	million units/yea	2	2.5	dem_DAC	1.0	2.5	5.5
EnzyTech Multiple	million units/yea	2	1.6	Enz_M	1.3	1.6	1.8
Demand Growth Rate	% / year	2	0.1	DGR	-5%	7%	9%
Costs uncertainties							
Unit Revenue	$ / unit	2	10.8	UR	9.75	10.75	11.50
Production cost	$ / unit	2	9.5	PC	9.25	9.50	9.75
Plant Construction Cost	$ million	2	14.5	PCC	13.0	14.5	17.0

Section 4 - Calculations

No Partnership / No Expansion

Year		2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period		0	1	2	3	4	5	6	7	8	9
Sales											
Demand | DA Corp. Markets	MM units	2.50	2.68	2.86	3.06	3.28	3.51	3.75	4.01	4.30	4.60
Demand | EnzyTech Markets	MM units	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Capacity	MM units	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Sales	MM units	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Revenue	MM $	26.88	26.88	26.88	26.88	26.88	26.88	26.88	26.88	26.88	26.88
Production Cost	MM $	23.75	23.75	23.75	23.75	23.75	23.75	23.75	23.75	23.75	23.75
Plant Cost	MM $	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JV Payment	MM $	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Royalty Payment	MM $	26.34	26.34	26.34	26.34	26.34	26.34	26.34	26.34	26.34	26.34
Earnings Before Tax	MM $	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13
Taxes	MM $	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19
Tax Credit Available for Next Year	MM $	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tax Payment	MM $	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19
Cash Flow	MM$	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94
Present Equivalent	MM 2026 $	$ 14.04									

Figure 24: NPV model for Alt. 1

Daylight Alchemy Corporation's Value Model

Section 1 - Strategy Selection

Strategy	2	strategy
Strategy Name	No Partnership / Expansion	strategy_name

Strategy Descriptions
    1 No Partnership / No Expansion
    2 No Partnership / Expansion
    3 Joint Venture
    4 Royalty

Here you can select the alternative that you want. Just enter the appropriate number. The cell that contains this number is called "strategy".

Section 2 - Constants

Description	Units	Value	Name
Real discount rate	%	8%	discount_rate
Tax Rate	%	38%	tax_rate
JV share	%	60%	JV_share
RP share	%	98%	RP_share

Section 3 - Uncertainties

Description	Units	Index		In Use	Name	Low	Base	High
Demand uncertainties								
DA Corp. markets	million units/yea	2		2.5	dem_DAC	1.0	2.5	5.5
EnzyTech Multiple	million units/yea	2		1.6	Enz_M	1.3	1.6	1.8
Demand Growth Rate	% / year	2		0.1	DGR	-5%	7%	9%
Costs uncertainties								
Unit Revenue	$ / unit	2		10.8	UR	9.75	10.75	11.50
Production cost	$ / unit	2		9.5	PC	9.25	9.50	9.75
Plant Construction Cost	$ million	2		14.5	PCC	13.0	14.5	17.0

Section 4 - Calculations

No Partnership / Expansion

Year		2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period		0	1	2	3	4	5	6	7	8	9
Sales											
Demand | DA Corp. Markets	MM units	2.50	2.68	2.86	3.06	3.28	3.51	3.75	4.01	4.30	4.60
Demand | EnzyTech Markets	MM units	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Capacity	MM units	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Sales	MM units	2.50	2.68	2.86	3.06	3.28	3.51	3.75	4.01	4.30	4.60
Revenue	MM $	26.88	28.76	30.77	32.92	35.23	37.69	40.33	43.16	46.18	49.41
Production Cost	MM $	23.75	25.41	27.19	29.09	31.13	33.31	35.64	38.14	40.81	43.66
Plant Cost	MM $	14.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JV Payment	MM $	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Royalty Payment	MM $	26.34	28.18	30.15	32.26	34.52	36.94	39.53	42.29	45.25	48.42
Earnings Before Tax	MM $	-11.38	3.34	3.58	3.83	4.10	4.38	4.69	5.02	5.37	5.75
Taxes	MM $	-4.32	1.27	1.36	1.45	1.56	1.67	1.78	1.91	2.04	2.18
Tax Credit Available for Next Year	MM $	4.32	3.05	1.69	0.24	0.00	0.00	0.00	0.00	0.00	0.00
Tax Payment	MM $	0.00	0.00	0.00	0.00	1.32	1.67	1.78	1.91	2.04	2.18
Cash Flow	MM$	($11.38)	$3.34	$3.58	$3.83	$2.78	$2.72	$2.91	$3.11	$3.33	$3.56
Present Equivalent	MM 2026 $	$ 8.95									

Figure 25: NPV model for Alt. 2

Daylight Alchemy Corporation's Value Model

Section 1 - Strategy Selection

Strategy	3	strategy
Strategy Name	Joint Venture	strategy_name

Strategy Descriptions
1 No Partnership / No Expansion
2 No Partnership / Expansion
3 Joint Venture
4 Royalty

Here you can select the alternative that you want. Just enter the appropriate number. The cell that contains this number is called "strategy".

Section 2 - Constants

Description	Units	Value	Name
Real discount rate	%	8%	discount_rate
Tax Rate	%	38%	tax_rate
JV share	%	60%	JV_share
RP share	%	98%	RP_share

Section 3 - Uncertainties

Description	Units	Index		In Use	Name	Low	Base	High
Demand uncertainties								
DA Corp. markets	million units/year	2		2.5	dem_DAC	1.0	2.5	5.5
EnzyTech Multiple	million units/year	2		1.6	Enz_M	1.3	1.6	1.8
Demand Growth Rate	% / year	2		0.1	DGR	-5%	7%	9%
Costs uncertainties								
Unit Revenue	$ / unit	2		10.8	UR	9.75	10.75	11.50
Production cost	$ / unit	2		9.5	PC	9.25	9.50	9.75
Plant Construction Cost	$ million	2		14.5	PCC	13.0	14.5	17.0

Section 4 - Calculations

Joint Venture

Year		2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period		0	1	2	3	4	5	6	7	8	9
Sales											
Demand | DA Corp. Markets	MM units	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demand | EnzyTech Markets	MM units	4.00	4.28	4.58	4.90	5.24	5.61	6.00	6.42	6.87	7.35
Capacity	MM units	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Sales	MM units	4.00	4.28	4.58	4.90	5.24	5.61	6.00	6.42	6.87	7.35
Revenue	MM $	43.00	46.01	49.23	52.68	56.36	60.31	64.53	69.05	73.88	79.05
Production Cost	MM $	38.00	40.66	43.51	46.55	49.81	53.30	57.03	61.02	65.29	69.86
Plant Cost	MM $	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JV Payment	MM $	3.00	3.21	3.43	3.68	3.93	4.21	4.50	4.82	5.15	5.52
Royalty Payment	MM $	42.14	45.09	48.25	51.62	55.24	59.10	63.24	67.67	72.40	77.47
Earnings Before Tax	MM $	2.00	2.14	2.29	2.45	2.62	2.81	3.00	3.21	3.44	3.68
Taxes	MM $	0.76	0.81	0.87	0.93	1.00	1.07	1.14	1.22	1.31	1.40
Tax Credit Available for Next Year	MM $	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tax Payment	MM $	0.76	0.81	0.87	0.93	1.00	1.07	1.14	1.22	1.31	1.40
Cash Flow	MM$	$1.24	$1.33	$1.42	$1.52	$1.63	$1.74	$1.86	$1.99	$2.13	$2.28
Present Equivalent	MM 2026 $	$ 11.90									

Figure 26: NPV model for Alt. 3

Daylight Alchemy Corporation's Value Model

Section 1 - Strategy Selection

| Strategy | | 4 | strategy |
| Strategy Name | | Royalty | strategy_name |

Strategy Descriptions
  1 No Partnership / No Expansion
  2 No Partnership / Expansion
  3 Joint Venture
  4 Royalty

Here you can select the alternative that you want. Just enter the appropriate number. The cell that contains this number is called "strategy".

Section 2 - Constants

Description	Units	Value	Name
Real discount rate	%	8%	discount_rate
Tax Rate	%	38%	tax_rate
JV share	%	60%	JV_share
RP share	%	98%	RP_share

Section 3 - Uncertainties

Description	Units	Index	In Use	Name	Low	Base	High
Demand uncertainties							
DA Corp. markets	million units/year	2	2.5	dem_DAC	1.0	2.5	5.5
EnzyTech Multiple	million units/year	2	1.6	Enz_M	1.3	1.6	1.8
Demand Growth Rate	% / year	2	0.1	DGR	-5%	7%	9%
Costs uncertainties							
Unit Revenue	$ / unit	2	10.8	UR	9.75	10.75	11.50
Production cost	$ / unit	2	9.5	PC	9.25	9.50	9.75
Plant Construction Cost	$ million	2	14.5	PCC	13.0	14.5	17.0

Section 4 - Calculations

Royalty

Year		2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period		0	1	2	3	4	5	6	7	8	9
Sales											
Demand | DA Corp. Markets	MM units	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demand | EnzyTech Markets	MM units	4.00	4.28	4.58	4.90	5.24	5.61	6.00	6.42	6.87	7.35
Capacity	MM units	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sales	MM units	4.00	4.28	4.58	4.90	5.24	5.61	6.00	6.42	6.87	7.35
Revenue	MM $	43.00	46.01	49.23	52.68	56.36	60.31	64.53	69.05	73.88	79.05
Production Cost	MM $	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plant Cost	MM $	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JV Payment	MM $	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Royalty Payment	MM $	42.14	45.09	48.25	51.62	55.24	59.10	63.24	67.67	72.40	77.47
Earnings Before Tax	MM $	0.86	0.92	0.98	1.05	1.13	1.21	1.29	1.38	1.48	1.58
Taxes	MM $	0.33	0.35	0.37	0.40	0.43	0.46	0.49	0.52	0.56	0.60
Tax Credit Available for Next Year	MM $	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tax Payment	MM $	0.33	0.35	0.37	0.40	0.43	0.46	0.49	0.52	0.56	0.60
Cash Flow	MM$	$0.53	$0.57	$0.61	$0.65	$0.70	$0.75	$0.80	$0.86	$0.92	$0.98
Present Equivalent	MM 2026 $	$ 5.12									

Figure 27: NPV model for Alt. 4

								EU	X
						Unit Revenue			
				DA Corp. markets		High	0.25	0.48	$ 19.66
				High 0.27633	0.25	Base	0.5	0.31	$ 11.23
						Low	0.25	0.00	$ –
		Production cost				**Unit Revenue**			
						High	0.25	0.48	$ 19.66
		High 0.24805	0.25	Base 0.27633	0.5	Base	0.5	0.31	$ 11.23
						Low	0.25	0.00	$ –
						Unit Revenue			
						High	0.25	0.29	$ 10.41
				Low 0.16322	0.25	Base	0.5	0.18	$ 5.95
						Low	0.25	0.00	$ –
						Unit Revenue			
				DA Corp. markets		High	0.25	0.53	$ 22.47
				High 0.34099	0.25	Base	0.5	0.37	$ 14.04
						Low	0.25	0.09	$ 2.81
						Unit Revenue			
						High	0.25	0.53	$ 22.47
No Partnership / No Expansion									
EU	0.30546	Base 0.30667	0.5	Base 0.34099	0.5	Base	0.5	0.37	$ 14.04
CE	$ 10.94					Low	0.25	0.09	$ 2.81
						Unit Revenue			
						High	0.25	0.33	$ 11.90
				Low 0.20368	0.25	Base	0.5	0.22	$ 7.43
						Low	0.25	0.05	$ 1.49
						Unit Revenue			
				DA Corp. markets		High	0.25	0.57	$ 25.27
				High 0.39988	0.25	Base	0.5	0.43	$ 16.85
						Low	0.25	0.17	$ 5.62

| | | | | | | High | 0.25 | 0.57 | $ 25.27 |

DA Corp. markets

| | | High | 0.25 | Base | 0.5 | 0.43 | $ 16.85 |

High
0.39988

| | | Low | 0.25 | 0.17 | $ 5.62 |

Unit Revenue

| | | | High | 0.25 | 0.57 | $ 25.27 |

| Low | 0.25 | Base | 0.5 | Base | 0.5 | 0.43 | $ 16.85 |

0.36046 0.39988

| | | Low | 0.25 | 0.17 | $ 5.62 |

Unit Revenue

| | | High | 0.25 | 0.36 | $ 13.38 |

| | | Low | 0.25 | Base | 0.5 | 0.26 | $ 8.92 |

0.24219

| | | Low | 0.25 | 0.09 | $ 2.97 |

EU   x

DA Corp. markets

| | | High | 0.25 | 0.84 | $ 54.46 |

Unit Revenue

| High | 0.25 | Base | 0.5 | 0.49 | $ 20.37 |

0.47111

| | | Low | 0.25 | 0.06 | $ 1.90 |

DA Corp. markets

| | | High | 0.25 | 0.64 | $ 30.51 |

No Partnership / Expansion

| EU | 0.17139 | Base | 0.5 | Base | 0.5 | 0.26 | $ 8.95 |
| CE | $ 5.64 | 0.26182 |

| | | Low | 0.25 | -0.11 | $ (3.04) |

DA Corp. markets

| | | High | 0.25 | -0.08 | $ (2.43) |

| | | Low | 0.25 | Base | 0.5 | -0.33 | $ (8.50) |

-0.3092

| | | Low | 0.25 | -0.50 | $ (12.10) |

EU   x

Unit Revenue

| | | High | 0.25 | 0.64 | $ 30.55 |

DA Corp. markets

| High | 0.25 | Base | 0.5 | 0.47 | $ 19.10 |

0.42503

| | | Low | 0.25 | 0.12 | $ 3.82 |

							EU	x
					Unit Revenue			
				DA Corp. markets	High	0.25	0.64	$ 30.55
			High 0.42503	High 0.25	Base	0.5	0.47	$ 19.10
				Low	0.25	0.12	$ 3.82
				Unit Revenue			
		Demand Growth Rate		High	0.25	0.50	$ 20.64
		High 0.30309	Base 0.25	Base 0.31971	Base	0.5	0.35	$ 12.90
				Low	0.25	0.08	$ 2.58
				Unit Revenue			
				High	0.25	0.24	$ 8.27
			Low 0.25	Base 0.14791	Base	0.5	0.16	$ 5.17
				Low	0.25	0.03	$ 1.03
				Unit Revenue			
			DA Corp. markets	High	0.25	0.64	$ 30.55
			High 0.42503	High 0.25	Base	0.5	0.47	$ 19.10
				Low	0.25	0.12	$ 3.82
				Unit Revenue			
Joint Venture				High	0.25	0.47	$ 19.03
EU 0.2759	Base 0.5	Base 0.29064	Base 0.5	Base 0.30018	Base	0.5	0.33	$ 11.90
CE $ 9.68				Low	0.25	0.08	$ 2.38
				Unit Revenue			
				High	0.25	0.22	$ 7.61
			Low 0.25	Base 0.13718	Base	0.5	0.15	$ 4.76
				Low	0.25	0.03	$ 0.95
				Unit Revenue			
			DA Corp. markets	High	0.25	0.58	$ 26.06
			High 0.38028	High 0.25	Base	0.5	0.42	$ 16.29
				Low	0.25	0.10	$ 3.26

No Partnership / No Expansion

CE(in millions)	$ 10.94

			Unit Revenue			
			High	0.25	0.58	$ 26.06
	DA Corp. markets					
	High 0.25	Base	0.5	0.42	$ 16.29
	0.38028					
		Low	0.25	0.10	$ 3.26
			Unit Revenue			
			High	0.25	0.33	$ 11.91
Low 0.25	Base 0.5	Base	0.5	0.22	$ 7.44
0.21924	0.20391					
		Low	0.25	0.05	$ 1.49
			Unit Revenue			
			High	0.25	0.15	$ 4.76
	Low 0.25	Base	0.5	0.09	$ 2.98
	0.08887					
		Low	0.25	0.02	$ 0.60

			EU x			
			DA Corp. markets			
			High	0.25	0.33	$ 12.23
	Demand Growth Rate					
	High 0.25	Base	0.5	0.17	$ 5.56
	0.18615					
		Low	0.25	0.07	$ 2.22
			DA Corp. markets			
			High	0.25	0.31	$ 11.25
Royalty						
EU 0.16141	Base 0.5	Base	0.5	0.16	$ 5.12
CE $ 5.28	0.17306					
		Low	0.25	0.07	$ 2.05
			DA Corp. markets			
			High	0.25	0.21	$ 7.04
	Low 0.25	Base	0.5	0.10	$ 3.20
	0.11336					
		Low	0.25	0.04	$ 1.28

Figure 28: Decision Tree