Case 2

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Peru Gems

**Overview**

Our project was on Valuing Peru Gems, and we are case number two. This case involves an investment proposal in a sapphire mine in Montana. The company is called Peru Gems, which is a family-owned business with $45 million in total assets, including $4 million in cash reserves. The owner, Maxine Peru, owns the land that the project will be on. Testing indicates the land is expected to produce 340 tons of raw sapphires per year for seven years. The land also contains gem-quality garnets and could produce 150 pounds per year. The garnets are held in “pockets” which makes the prediction of the production difficult to estimate. Pricing for high-quality garnets is $3,300 per pound. The price of sapphires is much less predictable and has a lot of variation. Ms. Peru believes that the price of sapphires will be $10,000 per ton and increase with inflation at 3.5% per year. However, some experts believe the price will be at $14,000 per ton, while others believe the price will be $7,500 per ton.

There are two proposals for the mine, the original design, and a cheaper design. The original design is supposed to cost $10 million for the machinery and facilities. But overruns are common for mines and could increase the cost of the mine by 10% to 15%. Operating costs are expected to be $900,000, which includes $400,000 in fixed costs and $500,000 in variable costs. Operating costs are expected to increase with inflation at 3.5% per year. The cheaper design is supposed to decrease the cost of the mine by $1.7 million. This design is also supposed to eliminate much of the uncertainty with the cost overruns. Variable costs are the same at $500,000 but fixed costs are expected to increase to $850,000 per year. There is also a new environmental regulation that could pass that would increase the cost of the mine by $1.5 million. Both mines can be depreciated straight-line over seven years. We also found that mines with similar risk to this project have a nominal return of 14%. The project is the 30% tax bracket. With all of this information, we are going to be looking to see what the NPV is of the base-case scenario with the original mine and with the cheaper mine. We are then going to be using what we find to determine which mine should be selected. Then we will determine the effects of the uncertainty surrounding potential cost overruns, and if they are important in our decision on accepting or rejecting the NPV. To view how we calculated these numbers, please click [here](https://docs.google.com/spreadsheets/d/19T9EqDrDH6rZjYXqhWQN8_zKeEnzL9QwebyBLOs3IYI/edit?usp=sharing) to access the spreadsheet, or copy and paste the following link: <https://docs.google.com/spreadsheets/d/19T9EqDrDH6rZjYXqhWQN8_zKeEnzL9QwebyBLOs3IYI/edit?usp=sharing>

Match the message in red under the calculations with the message in red on the spreadsheet. Maneuver through the spreadsheet with tabs at the bottom just like in Excel. For instance, “\*5 *in Overruns*” is the first table in the “Overruns” tab. All of the needed calculations are in the boxed table above the message in red.

# **Question 1: What is the NPV of the base-case scenario with the 10 million mine? With the cheaper mine? Which mine should be selected?**

Our first step in this project was to determine what would be the NPV of the base-case $10 million mine. Essentially, what base case determines is what management deems to happen. When we analyzed the base-case scenario, we determined the best possible scenario to ameliorate our explicit understanding of the NPV in terms of the base-case scenario and give management (us) a more concrete and correct NPV. Along with finding the NPV, we need to keep in mind and account for the possibility of environmental regulations that can be put into place at any given time. With that being said, we started to calculate the base-case mine NPV (both with and without the environmental regulations) and the NPV of the cheaper mine. Below we have the price of the two mines without the possible environmental regulations. In both cases, we can accept either mine and management would be pleased, but the best mine for our interests, in this case, would be the cheaper with the higher NPV.

|  |  |  |
| --- | --- | --- |
| NPV w/o regulations | Original Mine | Cheaper Mine |
| NPV | $700,022  \*1 *in Base Case* | $1,429,155 \*2 *in Base Case* |

After finding the NPV of the two mines with no regulations, the cheaper mine turned out to be the best option for Peru Gems. When we include the environmental regulation expenses at the beginning of the project, both the original mine and the cheaper mine have NPVs that are less than zero, meaning that we would reject both mines in these scenarios.

|  |  |  |
| --- | --- | --- |
| NPV w/ regulations | Original Mine | Cheaper Mine |
| NPV | -$799,978  \*3 *in Base Case* | -$70,845  \*4 *in Base Case* |

Regardless of whether the environmental regulations occur or not, if we choose to go with this project we should choose the cheaper mine because the base-case of the cheaper mine is greater than the base-case of the original mine with or without the environmental regulations.

# **Question 2: Show the effect of the uncertainty surrounding potential cost overruns. Are cost overruns important in your NPV accept-reject decision?**

For this project, there are a lot of uncertainties including cost overruns, price, production, and environmental regulations. These uncertainties will impact our cost, and can also impact our decision on whether we should accept or reject the NPV. Below, we did sensitivity analysis for each uncertainty and described what type of effect we could expect to see in the potential cost overruns and whether or not the cost overruns are important in our decision to accept or reject the NPV. We included the environmental regulations for the cost overruns, price, and production uncertainties, as we want to prepare the company for the worst possible scenario, as it might be included in our costs. Although we are unsure of whether or not the environmental regulations will be enforced or not, we know that there is a high possibility of having to endure this cost, as it is a very environmentally destructive process, and very likely that it will be included in our costs.

Overrun costs vary as high as 15% or as low as 0%. The following table shows how NPV will change with overruns and other variables held constant. Since the cheaper mine is supposed to eliminate most of the risk with overrun costs, the calculations are made using the original mine and include the environmental regulations.

|  |  |  |  |
| --- | --- | --- | --- |
| Original Mine | 0% Overrun | 10% Overrun | 15% Overrun |
| NPV | $16,238  \*5 *in Overruns* | -$799,978  \*6 *in Overruns* | -$1,208,085  \*7 *in* *Overruns* |

This table shows us the difference in the NPV at different cost overruns. There are great changes between each different NPV that we calculated, showing us that cost overruns are important on our decision of accepting or rejecting the NPV. In the table above we see that if we have a cost overrun of over 10% or 15%, we would not accept the NPV and would not go through with the project, as our NPV will be in the negatives. The only scenario here that we would accept is if the cost overrun is 0% because the NPV for this scenario is positive.

Our group found that when overruns are about 2.5% or greater on the original mine, it will be better to choose the cheaper mine. So unless the company believes they can keep the overruns below 2.5%, which is unlikely because overruns of 10% to 15% are common in the mining business, we should always choose the cheaper mine. Using this reasoning and as we showed in question 1, the cheaper mine is the safer and preferred mine. Thus, we will use the cheaper mine for our next calculations.

The price of sapphires has a lot of uncertainty as they could go from as high as $14,000 to as low as $7,500. The expected price of sapphires is $10,000 so we will use this price as the base case. For all three prices, we assumed that the price would increase with inflation at 3.5%. The price of garnets is expected to be stagnant at $3,300 so we assumed that it would stay at this price and not increase with inflation. The following table shows how NPV will change with price and other variables held constant. These calculations are made using the cheaper mine and assuming that the environmental regulations are passed.

|  |  |  |  |
| --- | --- | --- | --- |
| Cheaper Mine | High Price ($14,000) | Base Price ($10,000) | Low Price ($7,500) |
| NPV | $4,385,873  \*8 in *Price Variation* | -$70,845  \*9 *in Price Variation* | -$2,856,293  \*10 *in Price Variation* |

The table above shows us the difference in the NPV between different price points, as we’re uncertain of what the price is going to be. We can see that there is a huge difference in the NPV, between the different price levels. If we find that the price is high, then we will be able to accept the NPV and the project, however, if we have a low price or base price, then we would not be able to accept the NPV, since the values are in the negatives.

Production is another uncertainty that our group found. We noticed that there is only an expected and worst production because the scenario only gives variations for the garnets. Since the garnets are held in “pockets” below the ground, there is a possibility that we miss the “pocket” and don’t get any garnets. Thus, we set production at 150 pounds per year for the expected production and 0 pounds per year for the worst production. We are still assuming the environmental regulations are passed.

|  |  |  |
| --- | --- | --- |
| Cheaper Mine | Expected Production | Worst Production |
| NPV | -$70,845  \*11 *in Production Variation* | -$1,556,743  \*12 *in Production Variation* |

As you can see, there is a huge difference between the expected production NPV and the worst possible production NPV. In both scenarios, the NPV is negative meaning we would reject the project for both scenarios. This means that we would have to produce more than what we would expect, or hope that the environmental regulations are not passed.

Environmental regulations, like price, is something that we don’t have control over. We have no idea if or when the regulations could be enforced. We know from history that congress can be very slow when introducing new legislation so the regulations could come towards the later years of our project. For presentation purposes, we are placing the regulation costs at the beginning of the project when we first build the mine. The following chart shows how NPV will change depending on if the environmental regulations are enacted or not.

|  |  |  |
| --- | --- | --- |
| Cheaper Mine | Regulations Enacted | Regulations Not Enacted |
| NPV | -$70,845  \*13 *in Regulation Variation* | $1,429,155  \*14 *in Regulation Variation* |

Whether or not the environmental regulations will be enacted will make a huge difference in whether or not we accept the NPV. In this scenario, if the environmental regulations are enacted, then we won’t be able to accept the NPV, and we would not be able to accept the project. The environmental regulation is a concern for us because it will have a large effect on whether or not we accept the project, and we are not sure whether it is going to be implemented or not.

# **Summary**

In conclusion, this project involves a lot of risk in the form of overruns, price variation, production variation, and environmental regulation expenses. The price fluctuation of sapphires is cause for concern because it could be as high as $14,000 per ton or as low as $7,500 per ton. There is an alarming difference here and the differences in the NPV at those prices reflect that. While price varies for sapphires, the production varies with the garnets. Since the garnets are found in “pockets”, there is a possibility that we miss these “pockets” completely and don’t mine any garnets. While we expect to find 150 pounds per year of garnets, it is possible that we mine 0, so we must calculate for it. The NPV difference of our expectation to our worst-case -$1,485,898. This is a big difference which means it is critical that we find one of these garnet “pockets.” The risk that we have the most control over in this project is the overrun costs. Overruns on the original mine will raise the cost of the project and environmental regulations will make the NPV equal to -$799,978, which means we would reject the project. Fortunately, there is a cheaper mine that will eliminate much of the risk involved with overruns at the expense of higher yearly fixed costs. Other variables held constant, the cheaper mine will always have a higher NPV when overrun costs are greater than about 2.5%. Since overruns of 10% to 15% are common, it is unlikely that we will have overruns less than 2.5%. This cheaper mine will have an NPV of -$70,845 with environmental regulations occurring. If environmental regulations do not occur, the NPV of the cheaper mine increases to $1,429,155. After reviewing our options and calculations, since the expected NPV without the regulations is so large and the expected NPV with the regulations is only slightly negative, we suggest that we accept this project and use the cheaper mine. As we’ve shown, while there is a lot of risk, there is a lot of reward to this project.