THE JUNIOR MINING VALUATION HANDBOOK

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The Junior Mining Valuation Handbook

Chapter 1 - Introduction

Everyone knows how to get rich.

You buy things cheap and you sell them when they are expensive. It is as simple as that.

The problem is that this is going against human behavior. They buy things that are expensive because it has been going up for a long time and they sell when things are cheap because, well, it has been going down.

The truth is that most people never make it.

So how do you stand out in this difficult environment?

The answer is that a successful investor is one who understands what he buys even if the wind is blowing against him. One who carefully analyzes what he or she buys and when he sees an opportunity he is ready to step in.

That is what this book is about: Knowing which companies are good and which aren’t.

Whether you are a professional analyst, a banker or a hobby investor this book will serve as a guide to invest in the junior resource space.

It is written in a simple language and you don’t need a financial or technical background in order to follow along.

After reading this book you will never treat your investments as a casino again.

DEFINING VALUE

When referring to investments I often say that value is the most important feature.

The general Merriam-Webster definition of value is that it is something that is useful or important.

So what is value, how can it be found and how is it related to the price?

Warren Buffet once famously said that “Price is what you pay – value is what you get.”

Think about the value you get from your dish washer at home. You fill it with your dirty plates, saucepans and utensils. You then add some detergent and an hour or so later you get perfectly clean dishes out.

It adds value to your household.

In the context of investments we mean just that. Something that is both important and useful to your portfolio. It adds value when you find it useful.

Strictly speaking, the price of an asset has nothing to do with its value, but of course at some point, or price, the asset ceases to be as appealing to you.

We then talk about the asset being overvalued.

Furthermore, the price is of course important when you decide whether to accumulate or get rid of the assets in your portfolio.

Putting a number on the value of an asset will help you know when to start selling and buying and when to stop.

It sounds simple but is actually very hard.

Because of this I will try to showcase examples of outstanding value and put it next to something that also looks good but is far less useful in your portfolio.

By always looking for the value a particular security holds you will be able to discern the good investments from the bad. Your holdings will then be part of a balanced portfolio – a feat that they all should have anyway.

One of the most difficult things about investing in the natural resource space is how to value the many companies that are out there.

There are about 5000 different companies on the Canadian Venture Exchange and yet only a handful of those are truly viable, and most will not perform at all.

So how do you pick the winners from the many losers?

If you are anything like me, you don’t want to invest your hard earned money in a company that has no prospects, where Management consistently over promises without really making good on any kind of commitment and where investing turns out to be more of a chore than anything else.

However tempting it may be, don’t go there!

The key to invest in natural resources is to be able to pick the winners. This is what this handbook is about.

So who are the winners in the natural resource sector?

In this eBook I will lay out a strategy for how to value a junior mining company and which parameters to take into account.

In other words, I will show you a way to put a number on the value of the resource.

Financial terms like resource in the ground, front-end capital costs and internal rate of return will be discussed, but since the focus of the guide will be practical I will not go too deep into the theory of those technical expressions.

Rather I will use them and explain them along the way in boxes like this:

Fact Box:

As a rule of thumb, to invest in the natural resource space requires knowledge about management.

That is because 95% of the junior miners are inherently worthless.

A good management will make sure that all the things that I talk about in this book are carried out and verified by third parties.

A good management will not leave things sorting out themselves. They will instead actively pursue their task of providing value for shareholders.

It's really important that you make sure that the management has the required experience and skills to successfully steer the company through good times and bad, but sometimes you don’t and then what?

Do you really have to let go of an investment opportunity because you don’t know enough about management?

Actually you don’t.

The same way that due diligence doesn’t stop with the quarterly reports, it does certainly not stop with management either.

Both are equally important to analyze.

The composition of the management tells you something about the company, its strengths and weaknesses and overall experience with the legislation where the resource is located.

A good track record beats a bad every day of the week.

If management does not have the required experience of the conditions on the ground, please don’t invest your hard earned money there.

On the other hand, if these conditions are met, then you can dive into the quarterly reports and look at factors such as Net Present Value (NPV), Net Asset Value (NAV), Front-End Capital Costs (FECC) etc.

Then you will see that most new resource projects are not viable and that their management teams are nothing but a group of happy geologists with no background in finance.

That is sad.

Don't get me wrong, in the top 5% of the stocks the rewards can be extraordinary, but most of the companies simply don’t belong and rather than owning them you’d better go out looking for money growing in trees.

Amongst the winners you will find the famous “ten-baggers” - the ones that increase their value by a 1000% or more.

The difficulty is then to identify these stocks without prior knowledge of the management teams.

This guide will be about just that: Finding easy steps to correctly identify the viable projects from the non-viable ones.

I will not go too much into the theory of mining - you can find this information elsewhere - but rather on the financial aspects of valuing a resource.

I will also provide an easy to use checklist for mining valuation which will give you an edge over other investors.

In the end, aren't we all interested in making big profits?

Chapter 2 – The Investments

Investing in junior miners is a form of speculation. The definition of a speculator is a market participant who is betting on the future price movements.

This of course brings risks.

The downside is that all your money may be wiped out. This is especially true if you invest in companies with low grade resources that cannot be economically mined.

The upside can be extraordinary gains.

Of course it is not a good idea to put all your money into gold and miners. The bulk of your money should be elsewhere. But the money that you can play with should be as wisely invested as possible.

Modern portfolio theory states that there exist an optimal portfolio for your level of risk and then does the job of quantifying it. The calculations themselves are very theoretical and I won’t cover them here.

It all depends on your situation. If you own your own house or farm/woodland then your portfolio allocation will be different than if you don’t. If you are soon to be retired then your considerations will be different from a young employee, etc.

But if you don’t own any real estate I recommend about 35% in government bonds, 25% in Large Cap stocks, 10% in Small Cap stocks, 10% in precious metals, 10% in cash and 10% for speculation.

So it is these 10% of your overall portfolio that we are going to cover in this book, and to maximize the chances for the money to grow.

Chapter 3 - The Mining Industry

Depending on how you define them, the stock market usually contain 10 different sectors each with their own set of peculiarities and specifics.

According to Bloomberg, the Mining sector is not in itself defined as a sector in the stock market, but rather an industry within the broader sector Materials.

The mining industry is even more peculiar than the rest of the Materials sector.

I will now discuss the factors that set the mining industry apart from other sectors in the stock market.

One of the things about the mining sector in general and the junior mining sector in particular is that it is extraordinarily cyclical.

That's just the way things are.

Think of the mining sector as a leveraged bet on commodity prices and the Junior Mining Sector as this leveraged bet on steroids (now, when I say “leveraged” I mean the habit of banks and hedge funds to borrow copious amounts of money to increase a small potential percentage gain).

The driving force behind this is the “hot” money that flows from hedge funds into the mining sector when prices are rising. When everyone sees an opportunity, the idea of rising prices feeds on itself, which in turn lead to higher prices.

Valuations of equities are primarily driven by money flows. This is not something that is unique for the mining sector, but rather true for the market as a whole.

When “hot” hedge-fund money begins to flow into the mining sector and valuations rise, it is very difficult stopping them. It is this “wave” of money that we as investors want to identify and profit from.

In the aftermath of the crisis in 2008, the Chinese government decided to spend enormous amounts of money into the own economy.

While doing so, the Chinese also invested heavily in the natural resource space and kept demand up at the same that Western demand was falling like a rock.

This happened in an environment where prices on mining equities had been knocked down due to the crisis in the Western world.

The end result was a commodity boom that could be identified and played. Demand was almost rising on a daily basis and valuations in the mining sector with it.

The best cure for low prices is low prices.

The best cure for low prices is low prices. That is because low commodity prices almost invariably lead to higher commodity prices.

When there is a lot of product in the market, exploration and production budgets are slashed and new production of the commodity is reduced.

Less production then leads to higher prices and the cycle starts anew, but here is the rub: *higher commodity prices feed upon themselves and only become higher and higher.*

The best example of this in modern times was what happened in the beginning of the last decade.

Gold and silver prices were so beaten up that the Bank of England decided to sell all its gold because they didn’t see any use for it.

In retrospect, that seems to have been a historic mistake in that prices were at their bottom and were poised to go higher.

During the following twelve years, investors were finding enough value in gold to bid up prices each year.

Indeed, prices then rose every year until 2012 when they came to a halt.

This anecdote underlines the cyclical nature of the resource markets.

When prices look cheap to enough investors, money will begin to flow and what first is a very small flow will eventually turn into something much bigger.

It's then our job as investors to identify these trends and to profit from them.

Valuations of mining companies in the stock market roughly follow the commodity prices.

Stocks that in a bull market can sell for 30 times EBITDA (Earnings Before Interest Taxes Depreciation and Amortization) can in a bear market sell for as low as 1 x EBITDA.

This is truly remarkable, but nevertheless a feature of the natural resource sector, and a consequence of the psychology of the herd.

Each major trend is defined by three stages: the *accumulation* phase, where only a handful people invest their money, *consolidation* where prices tend to strengthen under the radar of most people and finally the *public participation* phase where ordinary people pile in and where prices tend to explode.

Where does that leave you as an investor?

What it comes down to is to be able to time the market and simply buy at the low points and sell at the high points.

Sounds easy, right?

The problem is of course that we don't know when the turning points arrive.

When the selling begins in earnest, there can be a long way down before prices recover. So what do you do then?

The key here is not to panic and stay calm during the whole downdraft.

Here technical analysis is useful and what I’ve found especially useful is to look at the weekly charts.

To get a snapshot of where the market is you can use the indicator 50-week moving average.

The moving average, together with many other indicators, can be found on the website FreeStockCharts.com.

The indicator takes the average price over a whole year so that short-term fluctuations are smoothened out.

When the price of the metal is trading below the 50-week MA then the indicator will move downwards or in other words, the slope of the indicator will be negative.

When this indicator begins to flatten out and eventually turn upwards it is time to get back into the market.

Of course, you will miss the first move from the lows when looking at the 50-week Moving Average, but this is a small price to pay in order to stay sane.

When the bottom is finally reached it’s a matter of Dollar-cost averaging to get back in because you don’t know that what you buy today will not be cheaper tomorrow.

Use a fixed amount each month to buy your favorite stocks to get a reasonable average price for your favorite stock and your favorite stock you find by doing the hard work of looking at the numbers.

Figure 1. Weekly chart for the price of gold at the end of June 2015. 50 week moving average is in blue, bullish weeks in green and bearish weeks in orange. Prices in USD.

In the same vein, begin to sell stock once it has exceeded its inherent value.

No you might think: Why do we do that? If prices have been doubling for the past year they will also continue to do so for the next year, right?

Wrong!

That is because past performance is no guarantee of future movement.

In this case the 50-week moving average that we talked about earlier is of no use.

However, the valuation metrics are.

Again, to identify an overvalued security you need to go to the horse’s mouth.

When prices are clearly overvalued on all metrics and you see daily price increases akin to the third manic phase that we discussed earlier then consider selling your stock.

You will probably miss the last 10 percent of the move, but it is a small price to pay in order to sleep well at night.

The second thing that must be understood about the mining sector is that it is extremely capital intensive.

To build mines, processing plants and then mining the ore cost a lot of money.

Yet only a handful of the CEOs in the junior mining companies have profound knowledge about finance.

Most of them come from an engineering background and lack the required expertise of how the industry works.

The upside to this is that you can always pick up the phone and talk to them directly, but the downside is that in most cases they lack the relevant knowledge.

They will present their case nicely, but when you actually look into their story, you will see the holes.

It comes down to picking the ones that do understand the business in which they operate. You don’t want to buy anything than the best of the projects that are out there.

Another thing to grasp about the natural resource sector is that many of the best projects are not located in safe jurisdictions.

That puts pressure on the management team to have extensive experience of the conditions on the ground of the country where the mine is located.

To put it bluntly, companies that cheat on this have no future in the resource sector.

The odds are better on the race track than on this kind of companies.

Resource confiscation by hostile governments is also commonplace in some parts of the world.

This puts additional pressure on you as an investor not to invest in companies where this might happen.

The last thing that you want to do is to invest in a company that sees all its investments in mines, processing plants and infrastructure being seized by government.

Countries like Venezuela and Zimbabwe come to mind, but also less obvious countries like the Central African Republic, The Congo and Niger are hot candidates where internal conflict has been raging as of late.

You simply don’t want your hard-earned cash to be confiscated by cigar smoking dictators.

Chapter 4 - The mine

As I mentioned in the introduction to this eBook, mining, refining and processing a resource is extremely capital intensive.

To get an idea of the kind of money involved, I will now briefly describe the technical steps needed to explore a resource, build a mine and their cost.

The terms involved in this chapter will forcibly be technical, but do not worry if you don’t understand. You can safely skip this and still follow the discussion on the financials of mining in Chapter 6.

So let’s get in to it.

First of all you need to find the resource in the ground.

It can be that someone has found stray pieces of metal on the surface, that low flying drones test positively for radioactivity (indicating presence of uranium) or simply that the lot is situated close to an old discovery.

That will then catch the interest of exploration geologists and they will begin to drill the ground.

The contents of the drill holes are then sampled and analyzed by metallurgy to figure out what is present in the ground.

Initially, the exploration stage include a *scoping study* where it is determined if the resource contain enough mineral to warrant economic extraction.

If these tests succeed, then the exploration will continue and the process is usually divided into *resource evaluation* and *resource definition*.

Resource evaluation has the purpose of finding a mineral resource, while *resource definition* is the process where the geologist converts a mineral resource into an ore reserve.

Resource definition is usually more technical than *resource evaluation* and requires a more advanced statistical study. The end goal is to define the ore body both by mass and grade.

The ore also needs to be defined with a reasonable level of certainty. It is not enough only to do some drilling and then build a mine.

This is because the market at least expects some scientific rigidity in order to invest in a resource project.

This certainty often comes with expensive consulting fees attached to it and it is what the market has come to accept as the gold standard of a resource project.

If I mentioned before that 99% of the companies in the resource business do not belong there, this is one of the tests that the companies need to pass.

If the company cannot show a thorough Feasibility Study of their discovery they most definitely do not belong in the business.

Remember that we are still only talking about the exploration phase. Then you need infrastructure like roads, electricity and water.

In the most remote places this does of course not exist and can be very expensive to install.

Then we have the whole process of mining the resource, which depending upon the character may be more or less easy.

In some cases the whole resource is located under water and you need to drain the whole area where the resource is situated before you can even begin to drill.

In others it is extremely deep under ground or the geochemistry can put up boundaries for how much you can actually mine of the resource in a given day.

Open pit mining, where the resource is located close to the surface and the ore is easily accessible, is of course good when it happens, but not something that can always be counted on.

In the cases where the ore is situated deep underground there is sometimes no alternative than to mine the ore in a traditional underground mine. This brings up the safety.

The company does not want to operate an inherently unsafe mine and in most places around the world they are required by law to operate the mine in a safe manner.

From a mining company’s perspective, this then adds to the overall costs.

Let’s say that you, the company, decide to build an underground, or a *hard rock* mine, what are then the steps involved?

Depending on the bedrock where the resource is situated, building an underground mine may be more or less difficult.

If the company is lucky, the cheapest option is to build a spiraling *decline* around the resource where the mined ore can be transported to the surface.

Declines are often started from a high wall in an *open pit* mine.

But sometimes the company is not so lucky and big holes need to be drilled in the bedrock in what is called *vertical shafts.*

Usually these shafts are made very close to where the resource is located to easily get access.

Then a system of horizontal *stopes* needs to be built into the resource in order to recover it.

The purpose of these is to transport the ore above ground. Here again, the costs involved are very high.

In Figure 2 a schematic representation of the holes involved is drawn.

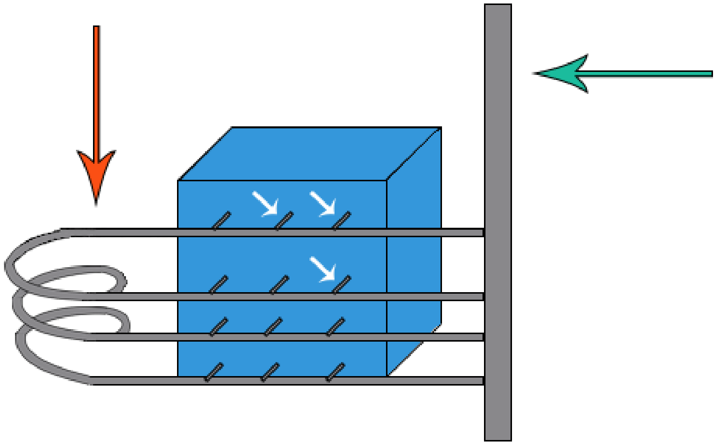

Figure 2. A schematic representation of the *shafts*, *ramps* and *stopes* of a conventional underground mine. The shafts, ramps and stopes are in grey while the resource itself is represented in blue. The green arrow points to the shaft, the orange arrow to the ramps and the white arrows to the stopes.

nce the ore is successfully mined you then need to process it in a processing plant where the end result is raw material.

Depending on the geochemistry of the ore there exist different extraction techniques, each with its own set of peculiarities.

For illustration purposes, let's take copper as an example. Many metals exist in nature as metal oxides. For instance you can have copper-oxide or nickel-oxide.

Now if we go back to our high school chemistry, we remember that when we treat a metal oxide with an acid we get a salt and water as a result.

The process involved here is very similar. When we treat a metal containing ore with sulfuric acid we get water and a metal salt out.

The chemistry involved looks like this:

$$CuO + H_2SO_4 \longrightarrow H_2O + CuSO_4$$

The method involved is called heap leaching and it uses the same basic principle as in high school:

The ore is treated with sulfuric acid, but instead of forming salt crystals by letting the water evaporate as we did in high school, the copper ions are now recovered from the solution directly.

The steps involved in *heap leaching* are the following:

1./ First the ore needs to be broken into smaller pieces so that it can be further treated in the chemical reactions in the refinement plant.

Remember that the goal is to get the metal out of the ore and turn it into shiny metal bars.

The ore may be hard so extra force may need to be applied to break it up.

2./ Say that the crushing works, the ore will then be placed on a moving rubber band with warm sulfuric acid dropping down on it.

The chemical reaction then takes place for a few days on the rubber band and the solution is then typically recovered at the end of the line in big containers.

3./ The copper ions are then typically recovered from the leach solution by simply fishing them out.

The copper ions can then be further used in the refinement process where the metal bars are made.

4./ The ore is then also recovered and the whole process starts again.

The reactions for Nickel are very similar to copper since Nickel too makes oxides.

Gold on the other hand exists in the ore as nuggets of free metal and usually a different acid (Hydrogen Cyanide) is used for the heap leaching.

Hydrogen Cyanide is of course extremely poisonous which again brings up the safety for the people working in the process, especially since the gold reaction takes place during days on the rubber line.

Silver is usually not mined on its own, but rather a by-product for other kinds of metals.

Now as you see, the extraction methods used have to be tailor made for the kind of metal ore involved and to know how to extract the metal requires experience.

These are all decisions that have to be taken well in advance of building the mine and as before the right management will take the right decisions whereas a less experienced management may or may not do so.

As always, the costs of not choosing the correct method for refinement can be prohibitory and for a small junior producer they can be fatal.

Again the experience of management is of utmost importance during these steps in the mining industry.

Chapter 5 – The Estimates

A resource company usually defines a resource in a Preliminary Economic Assesement (PEA) or at a later stage in a Feasibility study (FS).

The PEA:s and FS:s are typically made by external mining consulting companies with trained geologists that have the expertise to independently audit the resource.

These reports serve the purpose of defining what part of the resource is economic and can be mined at a reasonable cost.

A good report usually contains a detailed discussion of the resource itself, its size and recoverability. They should also contain details about the geochemistry of the ore and the mining process the company plan to use.

Furthermore, a properly done PEA or FS also contain a forecast of future cash flows expected from the mine.

These form the basis of the calculations that we will discuss in more detail later in the book.

Think about the reports as blueprints for the life span of the mine and use them as guides as where to allocate your capital.

As always, a highly concentrated resource project is better than a bad one and be careful not to invest in a company just because you like the narrative of the CEO.

The release itself is a major event in the life of a mining company. Depending on the market, the publication of a PEA or an FS can lead to big price swings.

These price gyrations stem from the fact that the market is expecting something based on the valuation of the company.

If the expectations are met, *i.e.* the resource is bigger and cheaper than expected, or surpassed, the price is likely to rise.

Similarly, if the market is disappointed by the size and economics of the resource then the price is likely to fall.

Unless you have inside information about a specific mining project, do not fall for the temptation to invest in a company that hasn't yet published a PEA/FS.

There are other holes where you can put your hard earned cash. The horse race track comes to mind.

> Do not fall for the hype and invest in miners without a published Feasibility Study.

The sweet spot in the life span of a mining company is companies that have already published a Feasibility study and is in the process of becoming a junior producer.

The prices of these will almost always rise in the market especially as more money pile into the stock. Coupled with rising metal prices the development can be extraordinary.

In Canada the Preliminary Economic Assessments and the Feasibility Studies are public information and downloadable from the System for Economic Document Analysis and Retrieval (SEDAR) web site.

In Australia there is a corresponding organization called JORC (Joint Ore Reserves Committee).

JORC is a professional code for reporting exploration results, mineral resources and ore reserves.

It states that companies listed on the Australian Securities Exchange (ASX) are required to report publicly on reserves under their control.

The data are compiled each year into a report called Australia's Identified Mineral Resources (AIMR) which is available on the internet (http://www.ga.gov.au/cedda/publications/1201).

If you are dealing with a company outside of Canada or Australia the reports may not be public, but a simple phone call to the company CEO usually fixes this.

If the company for some reason is keeping their reports secret it may be a sign of everything not being right and that you might want to get out of the investment.

The Reserves

When the company releases a PEA or a FS, they let independent geologists audit their resource.

Sometimes you hear the PEA go under the name of a Pre-Feasibility Study.

These geologists then make a professional estimate of how big the resource is and which parts that are economical.

In the Preliminary Economic Assessment the resources are defined as *Measured*, *Indicated* and *Inferred*.

The *Inferred* part is the portion of the resource that have been measured to a *reasonable level*, and which qualified geologists can state with a *reasonable degree confidence* to be economical.

This is the part that is the least certain both in terms of geology and economy. The exploration company may have drilled a few holes and know roughly how big it is, but they have no clear idea of its size or of its financial value. The independent geologist can then state that the resource belongs in the least certain category.

The *Indicated* part is the part where sampling has been made and where the qualified person can state with a *high degree of confidence* that it is economical.

This is where the estimates are more certain. The company has made a few more drill holes and sampled the resulting bedrock in a chemical laboratory. They know roughly what they have in the ground, how to recover it and that they can mine it economically. The auditor can then define the resource in the second most probable category.

The *Measured* part is where further sampling has been made and where the qualified geologist can state the resource to be *an acceptable estimate*.

This is the part that has been explored the most. The company has thoroughly drilled the ground, they know exactly what they have and importantly they have an idea of the economical value of the resource. The independent geologists can then do their own analysis and state the resource to be in the most certain category.

In this context it is also appropriate to discuss the grade.

When it comes to resource estimates nothing matters more than the grade.

You will often hear companies discuss their resources in terms of their cut-off value.

The mine cut-off value is the threshold used to determine if it is economical to mine a specific ore or not.

Please note that the grade is related to but not the same thing as the Measured, Indicated and Inferred resources that we discussed in the last section.

And here is the rub:

A concentrated resource is always of more value than a diluted one.

A concentrated resource is always of more value than a diluted one.

What it comes down to is being able to mine as little rock as possible in order to get the highest yield.

If a qualified geologist can state that resource X is more concentrated than resource Y, then resource X is always going to win.

The reason for this is simply that less ore need to be processed for resource X in order to get the same amounts of metal out, thus lowering overall costs.

As we’ve discussed before, cost is a major factor for junior resource companies aiming to become junior miners.

In the Feasibility study the nomenclature of the PEA changes and Measured, Indicated and Inferred *Resources* become Proven and Probable *Reserves*.

The proven reserves are the reserves that can be mined economically considering there will be acceptable losses during mining.

In other words, the proven reserves are a well defined estimate of the size of the resource and where the auditor knows how much can be converted into dollars.

The probable reserves are the part of the economical reserves that can be determined to a lesser degree of confidence than the proven reserves.

What this means is that the auditor does have an idea of the size and the economic value, but is less certain than for the proven reserves.

As a rule of thumb, to state this simply:

In the Preliminary Economic Assessment the measured and indicated resources become proven reserves in the Feasibility Study.

The inferred resources in the Preliminary Economic Assessment become *probable* reserves in the Feasibility Study.

This conversion is of course not a 100% accurate because both the sampling and the economic analysis are more thorough in the Feasibility Study, but it serves as a rule of thumb.

The different categories of Preliminary Economic Assessments and Feasibility Studies are listed in table 1.

Preliminary Economic Assessment (PEA)	**Feasibility Study (FS)**
Measured Resources	Proven Reserves
Indicated Resources	Proven Reserves
Inferred Resources	Probable Reserves

Table 1. The nomenclature of resources and reserves in Preliminary Economic Assessments and Feasibility Studies, respectively.

So why bother doing a Feasibility Study when a Preliminary Economic Assessment has already been made?

The answer is that in the PEA, the mineral resources are not proven economical the way the mineral reserves in the Feasibility Study are.

The Feasibility Study is a more solid piece of work with a much a higher degree of certainty, both when it comes to the geological and economic analysis.

Think of the PEA as a first draft without all the bells and whistles and the Feasibility Study as the final report.

It is also important to remember that neither the PEA nor the FS give the mining company a complete idea of what they are mining.

This understanding will only come once they start the tedious work of actually digging.

Prospect generators

As I’ve mentioned numerous times, the junior mining business is extraordinarily capital intensive.

Without capital there is no business for exploration companies and junior miners.

Furthermore, the business thrives on capital streams, which tend to flow in cycles.

To consistently be able to make money in the resource sector, bull market and bear markets alike must be identified and you had better be invested in good companies when the trend is rising.

So if you don't want to get involved with the figures yourself, but still want to invest in good companies, I would recommend you to take a look at the companies which are running the "prospect generator" business model.

Think of them as being the junior mine equivalent of a mutual fund that invests in solid dividend paying stocks,

Whereas a junior miner has a flagship project that can be quantified with numbers, a prospect generator company has many flagship projects.

They share their risk by teaming up with senior mining companies in joint ventures that spend money for exploration and development of mining projects for them.

They may not have all the upside that an ordinary junior mining company has, but they hedge their downside in a bear market by letting others pay for their continuing operations.

This means that they are able to run a successful business even in a downturn.

Wouldn't you want to invest in a company that has projects that senior mining companies are willing to pay serious money into? I know I would.

Chapter 6 - The Calculations

So now let’s turn to the real interesting part of investing in the junior mining industry - the money involved.

If you don’t have a background in accounting terms like Cash Flow, Future Value, Internal Rate of Return and Net Present Value will probably not make too much sense to you.

That is why I will go through them briefly so that you can follow the reasoning.

They are important when we want to put a number on the value of the resource to know what we want to invest in.

This is one example where it makes sense to use spreadsheets like Microsoft Excel.

It may seem counter-intuitive to use a program like Microsoft Excel in 2015, but it still makes sense because of the built-in financial formulas.

If you are using a different spread sheet program it is still possible to do the analyses but then the formulas will be different.

If you are serious about your investment decisions (which we all are) I would advice you to buy a copy of Microsoft Office.

The calculations can be made without spreadsheets, but they really make your life easier.

So let’s get into it.

Discount Rate, Present Value and Net Present Value

We then have to consider the Discount Rate, the Present Value and the Net Present Value.

In order to figure out what a future cash flow is worth today, we have to discount those cash flows back to get to the Present Value.

This method is called *Discounted Cash Flow analysis* or DCF.

It is a method used in capital budgeting.

Capital budgeting is what a company does when it considers what makes sense from a financial perspective, i.e. which long-term investments to make.

To express this in a fancy way, the purpose of Discounted Cash Flow analysis is to estimate the money you would receive from an investment and to adjust for the loss of value that money has over time.

Now, to calculate the Discounted Cash Flow (DCF), we must know what those Cash Flows are.

The only way to get to those is through estimation.

If we know the size of the resource we can estimate what the yearly production will be.

This number is then multiplied with an estimated future metal price and we get to our estimated cash flows.

But here is the rub:

When we calculate the Present Value of a future cash flow, we have to *discount those cash flows back* in order to get to the Present Value.

You then typically arrive at a value for that investment in today’s money.

Think about the discount rate as the return that you must earn on an asset.

To arrive at the discounted values, those future cash flows need to be divided with (1 + the discount rate in decimal form).

Now, if the value you arrive at through DCF analysis is higher than the cost today, then the investment is considered a good one.

The machine will add value to the firm.

The difference between the sum of our present values and the price is then called the Net Present Value.

Financial analysis like this is where Microsoft Office excels. We can use the built-in PV function to get to our present values.

If we for instance have our discount rate in cell C1 and our cash flows in cell E5 to C5, the Excel formula looks like this:

=PV(rate;nper;pmt;FV)

For the rate we navigate to the discount rate, click and then press F4 to lock that value.

The reason we do this is for the discount rate to stay constant if we want to update our calculations.

We then click on nper which is the period we are using. For the first year this is 1.

pmt we don’t have to worry about and the first cash flow is then entered as the FV and Excel calculates the Present Values for us.

An example of its use follows below:

F3 =PV(C1;E3;;C3)

	A	C	D	E	F
1	Annual Discount Rate:	0.15			
2	Cash Flow 0 (cost)	-$200 000.00		Period	Cash Flows
3	Cash Flow 1	$100 000.00		1	-$86 956.52
4	Cash Flow 2	$90 000.00		2	-$68 052.93
5	Cash Flow 3	$70 000.00		3	-$46 026.14
6	NPV = Value added to firm if project is undertaken	$1 035.59		Price willing to pay	-$201 035.59
7				Because cost of asset ($ 200 000) <=	
8					
9				Value added by buying at $200 000 = NPV =	$1 035.59

Figure 3. Example of how Present Values of future cash flows are calculated in Excel. The rate is entered at C1, the cost at C2, the periods at E3 to E5 and the estimated cash flows at C3 to C5. The Present Values of the cash flows are then calculated between F3 to F5.

While it is a good idea to use the PV function, if you are in charge of your spreadsheet I would advice you to double check your numbers by also entering them into the mathematical formula. Just to be sure.

The formula for the Present Value looks like this:

$$PV = \frac{C}{(1 + r)^t}$$

where:

C is the future value that has to be discounted.

t is the number of compounding periods.

r is the discount rate.

Figure 4. The Present Value of an estimated cash flow.

Net Present Value

In the last section we discussed the Present Value and how it is calculated. Now we will discuss the Net Present Value which also is a vital financial metric.

To get a feel for the term we first have to consider its definition:

The Net Present Value (or NPV) is defined as the sum of the present values of incoming cash flows over a period of time minus the initial investment.

The Net Present Value is defined as the sum of the present values of incoming cash flows over a period of time minus the initial investment.

What this term tells you is something about the profitability of an enterprise or a project.

To illustrate this, think about the salary you earn. Your salary earned today will not be worth as much tomorrow.

The same thing goes for the future cash flows of a resource company. They will also be worth less tomorrow than they are today.

The way that this is usually dealt with is by discounting the sum of the future cash flows by a percentage. This percentage is called the discount rate.

The way we deal with this is usually by taking the estimated cash flow for a year and divide it with *1 + the discount rate in decimal form*.

Now to grasp this conceptually you need to bring out your old High School math.

When we divide something by just 1 we get that same something out.

When we divide that something by (1 + the discount rate), we get a lower number out.

The same thing goes for cash flows.

We divide them by (1 + the discount rate) *to the power of the number of the year of the cash flow*.

So for every year the discount rate will be higher and it will be higher by raising (1 + the discount rate) to the number of years we want to estimate.

We then subtract the initial investment to get the Net Present Value.

The mathematical formula for the Net Present Value looks like this:

$$NPV = \sum_{t=0}^{T} \frac{C_t}{(1 + r)^t} - C_0$$

where:

C_t equals the cash flow for year t.

C_0 is the initial investment.

t is the number of years in question.

r is the discount rate.

Figure 5. The Net Present Value of given future cash flows.

What we do here is that we calculate the present values in the same way as we did in the former section.

We then *add the Present Values together* and *subtract the initial investment* to get to the Net Present Value.

For example, when a mining company wants to purchase another resource business with a producing mine, the company would first estimate the cash flows that the new mine would generate and then discount those cash flows into a lump sum.

If the owners of the mine would be willing to sell for less than this value then the purchasing company would likely accept as it presents a positive Net Present Value-investment.

We can also make use Microsoft Excel to calculate the Net Present Value directly.

However, the Microsoft Engineers who first programmed the Net Present Value function did not subtract the initial investment or the cost from the function. So we have to do this manually.

When we calculate the Net Present Value we therefore have to start our calculations at year 1 and then subtract the initial investment afterwards.

The Excel formula for the Net Present Value therefore looks like this:

=NPV(rate; value1; value2) – initial investment

where the rate is the discount rate used and value1 and value2 are the first and last cash flows respectively.

Again, let's look at an example.

A company invests $100 000 to get a positive cash flow of $70 000 for year 1, $43 500 for year 2, $25 000 for year 3, $25 000 for year 4 and -$2000 for year 5. The discount rate is 20%.

Does it make sense to buy?

We calculate the net present value to $14 262 which of course is a positive number, but not enough to warrant a buy of the machine.

So the answer is yes. The machine adds value to the firm.

D12 =NPV(D11;D5:D9)+D4

	A	B	C	D	E
1	Should we launch a new product that will be around for 5 years that has these cash flows?				
2					
3	Time	All Cash Out	All Cash In	Net Cash Flows	
4	Time 0	-$100 000		-$100 000	
5	Time 1	-$10 000	$80 000	$70 000	
6	Time 2	-$16 500	$60 000	$43 500	
7	Time 3	-$15 000	$40 000	$25 000	
8	Time 4	-$10 000	$35 000	$25 000	
9	Time 5	-$20 000	$18 000	-$2 000	
10					
11			Annual Rate of Return (Discount)	0.2	
12			NPV	$14 262	
13			Answer:	Yes	

Figure 6. Example of calculating the Net Present Value of future cash flows. The NPV-formula is entered as =NPV(rate; value1; value2) + initial investment where the cash flows used are the net cash flows (D5:D9). The plus sign for the initial investment comes from the fact that we have entered our cost as a negative (D4). The discount rate used is entered in D11.

Discount rate

In this section we will discuss the discount rate which should be kept conservative.

A discount rate of at least 10% is therefore to recommend, but it's a matter of personal preference.

We can use a rate of 7 or 8%, although I wouldn't want to go lower than that.

The reason is that this is a number that adds a margin of safety to our calculations.

Remember that the higher the discount rate the lower the profitability of the enterprise.

That is to say that the higher the discount rate the higher the margin of safety.

Typically, in the Feasibility Studies or PEA:s there are multiple scenarios considered and several Present Values calculated, each with different discount rates and estimated metal prices.

Here again, we are better off going to the horse's mouth and calculate the Present Value ourselves.

The reason for us doing so is to be sure that the playing field is leveled out so that we can compare different calculations with one another.

Payback Period

Then we need to consider the time it will take to get our initial investment back.

We do this by analyzing the *Payback Period*.

The formula looks like this:

$$\text{Payback Period} = \frac{\text{Cost of Investment}}{\text{Annual Cash Inflows}}$$

Figure 7. Formula for the Payback Period which is defined as the Cost of the Initial Investment divided by the Annual Cash Inflows.

That is to say that the shorter the payback period the better.

When we value resource companies, a good resource project should have a capital payback of less than 3 years.

For a good resource project, the payback period should be less than 3 years.

Payback period analysis does not take into account the profitability of a project. The profitability includes :

1./ the benefits that occur after the Payback Period has ended.

2./ the time value of money.

For this we use the Net Present Value and the Internal Rate of Return, but as a complement to these other metrics it is invaluable.

Of course we can calculate the Payback Period in Microsoft Excel and we do it like this:

	A	B	C
1			
2		Cost of Initial Investment	$450 000 000
3		Annual Cash Inflows	$125 000 000
4		Payback Period	3.6

Formula 8. The Payback Period on a given investment in Microsoft Excel. The cost of the investment is entered in C2, the annual cash inflows in C3 and the payback period in C4.

Net Present Value Profile and Internal Rate of Return

The next thing we need to consider is the Net Present Value Profile.

So what do companies do when they calculate the profitability of an investment?

Of course they use different values for their discount rate.

This means that each NPV-value both can and will be calculated with its own discount rate.

Again let’s consider the same example as above, but in this case we will use a range of discount rates from 5% to 35%.

Of course to do these calculations manually would be challenging, but in Microsoft Excel it is really easy.

IRR	29%	
NPV Profile		
Annual RRR (Discount)	NPV: Accept	NPV: Reject
5%	$46 718.90	
10%	$34 203.14	
15%	$23 499.20	
20%	$14 261.83	
25%	$6 224.64	
30%	-$820.51	-$820.51
35%	-$7 038.10	-$7 038.10

Figure 9. The NPV-profile calculated from the same cash flows as in Figure 6. The NPV-values are calculated for discount rates ranging from 5% to 35%. The positive NPV values are represented in black and the negative values are represented in red respectively and the Internal Rate of Return is represented above on the top of the figure.

Then what we see is that the NPV values are higher the lower discount rate and at some point they turn negative. We can display this like so:

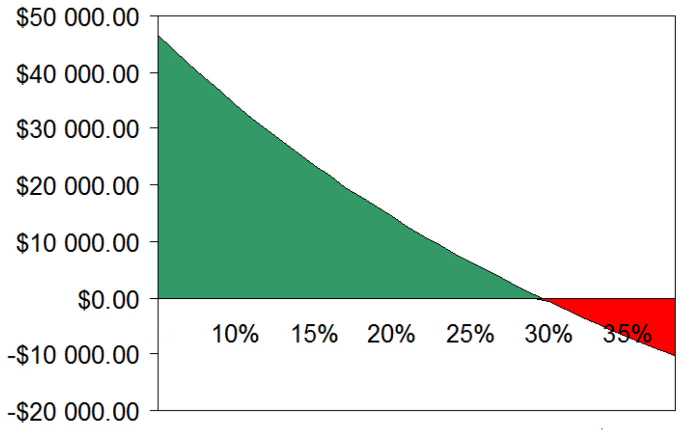

Figure 10. The NPV-profile for different discount rates as in Figure 7. The positive NPV-values are represented in green and the negative in red. The crossover from positive to negative is the internal rate of return (IRR).

So what we see in Figure 8 is that there is a point where the profits go from positive to negative. In this case that point is roughly 29%.

That point is called the *Internal Rate of Return* or IRR.

How do we use the IRR to figure out if our project is profitable?

We can see that if a project has a sufficiently high IRR then it is worth doing. It is worth doing because the NPV values will be positive at lower rates.

On the other hand if the IRR is low say 3% - 4% then it will be considered too risky.

In other words, the higher the internal rate of return the better. The higher the IRR, the more desirable it is for the company to undertake the investment.

The mathematical formula for the Internal Rate of Return looks like this:

$$NPV = \sum_{t=0}^{T} \frac{C_t}{(1+r)^t} = 0$$

where:

C is the future value that have to be discounted

t is the time of the cash flow.

r is the discount rate.

Figure 11. Mathematical formula for the Internal Rate of Return. The IRR is the discount rate where the Net Present Value is zero.

For the example that we used in Figures 6 to 8 the corresponding r will be calculated from:

$$NPV = -100000 + \frac{70000}{(1+r)^1} + \frac{43500}{(1+r)^2} + \frac{25000}{(1+r)^3} + \frac{25000}{(1+r)^4} + \frac{-2000}{(1+r)^5} = 0$$

Figure 12. Formula for the internal rate of return. Cash flows from Figures 6 to 8 are added and their NPV value is calculated. The IRR is then when the NPV is zero.

In Figure 9 the IRR is 29%.

For a junior resource project to be considered a good one, the IRR should be greater than 25% pre-tax.

Again, if you use Microsoft Excel the Internal Rate of Return can be calculated automatically, like so:

=IRR(values)

Where values are the cash flows that we want to analyze. We simply go to our cash flows (negative and positive) and click on them to select and the program then does it all for us.

This is how Microsoft Excel calculates the internal rate of return.

Then we need to introduce the concept of Enterprise Value (or EV).

In order to figure out the EV we need to dig into the annual or quarterly reports of the company and look at the Balance Sheet.

Generally speaking the EV is what you are currently paying for the company when buying stocks.

It includes the Market Capitalization of the company plus debt, preferred shares and minority interest, minus total cash and cash equivalents.

These are all accounting terms found in the annual report.

So what is the Market Cap?

It is the number of outstanding shares times the value of those shares. It is as easy as that.

Preferred shares then?

Preferred shares are issued by companies as an intermediary between shares and bonds.

Similar to bonds, the dividends of preferred shares are usually paid out before the common stock, but

…preferred shares have no voting rights at the Annual General Meeting. That is why there are both pros and cons of owning preferred shares.

In this context *minority interest* is when a company ABC owns 90% of XYZ. If XYZ is worth 100 million USD then ABC would have a 10 million liability on its balance sheet.

The formula for the Enterprise Value looks like this:

Enterprise Value = Market Capitalization - Current Assets - Non-Current Assets + Current Liablities + Non-Current Liabilities

In Microsoft Excel we can enter the Enterprise Value like this :

Current Valuation	$50
Number of shares outstanding	10 000 000
Market Capitalization	500 000 000
Current Assets	$160 000 000
Current Liabilities	-$100 000 000
Non-Current Assets	$567 000 000
Non-Current Liabilities	-$400 000
Enterprise Value	$1 126 600 000

Figure 13. The Enterprise Value is the sum of the Market Capitalization, Current Assets, Current Liabilities, Non-Current Assets and Non-Current Liabilities.

Net Asset Value (NAV)

The last thing that we need to get a grip on is the Net Asset Value or NAV.

NAV of a resource project is not the same as the Net Present Value, but they are related.

In fact the Net Asset Value is the sum of the Net Present Values for each project minus their liabilities.

To generalize this, the Net Asset Value is the sum of a company’s assets minus its liabilities.

In other words: The Net Asset Value is what the company is worth.

A company’s assets and liabilities can be found in the balance sheet of the annual or quarterly reports.

When it comes to resource companies the NAV is calculated as the Net Present Value plus cash and cash equivalents minus debt.

The formula for the Net Asset Value looks like this:

Net Asset Value = Net Present Value + Current Assets – Current Liabilities + Non-Current Assets – Non-Current Liabilities

So how do we arrive at the cash flows needed to calculate the Net Present Value in the first place?

Of course we need to figure out a way to value the metal that a company has in the ground.

So how do we do that?

When a mining company has acquired a resource or simply made a new big discovery, the size of the resource and the value of the project need to be estimated.

As we’ve already discussed, these estimations can be found in the Feasibility study or the PEA.

However, we often want to a use a different metal price than the company has used in our NPV calculations.

This will inevitably involve a bit of guesswork as it is about estimating the future price of the metal in question.

This is of course not easy.

Simply to take today's prices and extrapolating them into the future does not do since the metal prices have proven to be volatile over the long haul to say the least.

Our calculations will be highly dependent on the estimate that we are using for the metal price.

When metal prices fall, as they often do, valuations of the miners fall as well.

Nevertheless, it is a good idea being conservative when estimating a metal price, but not being too conservative.

A good starting point is to take today's prices and reduce them by 20%. In that way, there is a reasonable margin of safety that can be applied to the calculations.

However, it also depends on where in the market metal prices are.

For instance, if the market has had a good run and you expect a correction we may then want to consider reducing the estimate with more than 20% to be on the safe side.

If on the other hand, metal prices are severely depressed and you don't think that they will fall much lower, then a figure of less than 20% may be considered.

We don't want to base your calculations on neither a too optimistic nor a too gloomy scenario.

As with most things in life, a balanced level is the best.

Typically we would use several different scenarios:

- One pessimistic where we reduce the current price about 20%.
- One mediocre where we the current price is reduced about 10%.

- One where we assume the current price to stay the same for the next few years.
- One slightly optimistic where the current price is increased by 10%
- One more optimistic where we assume the current price to increase by 20%.

Once we have an estimate for the future metal price, we need to have an idea of the size of the resource.

Luckily for us estimates of how much ore can be processed each year has already been made for us in the Preliminary Economic Assessment or the Feasibility Study.

We can use these as a starting point in our calculations.

Once the size of the resource is defined we will have to divide the size with the expected number of years that the mine will be in operation.

This is reasonable given that the mine will only be viable for a certain amount of time.

In this context it is important to remember that when a resource is used up it's gone and after that no production will come out of it.

Of course there will be variations in the production numbers over the lifetime of the mine, but as an approximation we can say that the production numbers will stay constant over the years.

The estimates of the size of the resource are divided with the number of years the mine is planned to be in operation. What we get out is the average production numbers per year.

In Figure 14 we calculate the production numbers during the life span of a hypothetical silver discovery.

Resource Estimate: 36,000,000 oz
Life-span of mine: 15 years

Estimated production per year:

$$\frac{36{,}000{,}000 \text{ oz}}{15 \text{ years}} = 2{,}400{,}000 \text{ oz/year}$$

Figure 14. Production numbers of a hypothetical silver discovery of 36 million ounces. The life-span of the mine is estimated to be 15 years.

If these numbers come from a press release it is what the company believes is under ground and not audited numbers.

As we discussed previously, we have to be careful when we want to determine the authenticity of such numbers.

This is the reason why you will always be better off having independently audited numbers either in a Feasibility Study (better) or a Preliminary Economic Assessment than just a press release from the company.

If we go to the PEA and look at the size of the discovery we see that in a hypothetical gold discovery we have Measured Resources of 500 000 ounces, Indicated Resources of 200 000 ounces and Inferred Resources of 50 000 ounces.

In addition we also have Measured Reserves of 750 000 ounces, Indicated Resources of 250 000 ounces and Inferred Resources 75 000 ounces of silver.

So how do we calculate the value of these metals in Microsoft Excel if we use a metal price of 1100 USD/oz?

It looks like this:

	A	B	C	D
1				
2		Type	# of ounces	Valuation (USD)
3		Measured Gold Resources	500 000	550 000 000
4		Indicated Gold Resources	200 000	220 000 000
5		Inferred Gold Resources	50 000	55 000 000
6		Total Gold Resources	750 000	825 000 000
7				
8		Measured Silver Resources	750 000	825 000 000
9		Indicated Silver Resources	250 000	275 000 000
10		Inferred Silver Resources	75 000	82 500 000
11		Total Silver Resources	1 075 000	1 182 500 000
12				
13		Total Metal Valuation		2 007 500 000
14				
15		Metal Price (USD/oz)	1 100	

Figure 16. Metal Valuation of a hypothetical gold and silver deposit. The estimated metal price is entered in C15 and valuations for measured, indicated and inferred resources are entered in C6 and C11 and finally added together in D13.

To calculate the Net Asset Value we can enter the values in Microsoft Excel like so:

	A	B	C
1			
2		Net Present Value at Discount Rate 10%	$565 300 000
3		Current Assets	$160 000 000
4		Current Liabilities	-$120 000 000
5		Non-Current Assets	$67 000 000
6		Non-Current Liabilities	-$300 000
7		Net Asset Value	$672 000 000

Figure 16. The Net Asset Value of a resource is calculated as the sum of the Net Present Value at a given discount rate, current assets, current liabilities, non-current assets and non-current liabilities.

Other valuation methods

Sometimes the valuation methods described above are not enough to get a clear picture of the value a company.

When that’s the case you may want to consider a few alternative methods.

We will now briefly discuss those, but please note that this discussion will be even more limited in scope than the previous one.

Average Accounting Return (AAR)

Another financial valuation method is the Average Accounting Return.

It uses the accounting values found in the company’s income statement rather than cash flow.

For a junior miner the company’s earnings will be small at best and even negative in most cases.

Thus the AAR doesn’t really apply in the junior space, but is more a method used for established miners with existing mine production.

The method is far less reliable than the NPV that we discussed above, but financial analysts still like to use it together with other valuation methods.

AAR’s main drawbacks are that it fails to:

1. Take into account the time value of money. As such it will seem more lucrative than it really is.
2. Take into account the risk. When we calculate the NPV or IRR we use the discount rate which does include the risk.

As we mentioned above, the AAR is also pretty useless for junior miners because it relies on accounting values and not on cash flow information.

Profitability Index (PI)

The Profitability Index is a method to calculate the relative profitability of an enterprise.

It can be defined as:

$$PI = \frac{PV}{IC}$$

where:

PI is the Profitability Index

PV is the Present Value

IC is the initial cost of the investment

Figure 17. Formula for the Profitability Index.

We see that instead of subtracting the initial costs from the Present Value we divide the costs.

What we get in the end is a ratio that tells us something about the profitability of a project.

If the ratio is less than 1 we should not invest in the enterprise.

It makes sense. If the sum of our discounted cash flows is smaller than the cost of the investment it does not make sense to invest.

On the other hand if the ratio is above 1 the project is worth accepting.

Then the sum of our discounted cash flows is greater than the initial investment.

Again this can be calculated in Microsoft Excel, like so:

E3 f_x =NPV(E1;B3:B9)/-B2

	A	B	C	D	E
1	Time	Cash Flow		Discount Rate:	16%
2	0	-$165 000		Present Value:	$162 482
3	1	$44 000		Profitability Index:	0.98
4	2	$44 000		Profitability Index - 1:	-0.02
5	3	$44 000			
6	4	$44 000			
7	5	$44 000			
8	6	$44 000			
9	7	$1 000			

Figure 17. Profitability Index with the initial investment entered in B2, the cash flows in B3 to B9, the discount rate in E1, the present value in E2, the profitability index in E3 and the profitability index -1 in E4.

The profitability index is then calculated as NPV(E1;B3:B9)/-B2.

Note that we’ve entered the initial cost as a negative so we have put a negative sign in front of B2.

Then what we can do is to calculate the profitability index minus 1.

This will tell us the added value as a percentage.

In the example above we will get a negative 0.02 or 2% which means that will have to pay 2 pennies for each dollar invested.

So will we invest in this enterprise?

No, based on these criteria we will reject the investment.

Accounting terms

A junior miner’s financial position cannot be properly analyzed without the financial statements.

As we’ve already mentioned, the mining business is highly capital intensive and most junior miners don’t have the financial wherewithal to support their operations in bad times let alone in good times.

Trouble is that the companies do what they can to paint an as rosy picture as possible.

Luckily for us as investors there are only a few of all the items in the financial reports that we really need.

These items are all audited by external auditors and cannot be obfuscated.

In this section we will have a look at those accounting terms and explain why they are important.

Working capital

This is an accounting term that is very commonly used both by accountants and financial analysts.

To figure it out we need to dig into the company's balance sheet which can be found in the annual or quarterly reports.

We can define the working capital as such:

$$\textbf{Working Capital} = \text{Current Assets} - \text{Current Liabilities}$$

In essence the current assets term is a measure for how much cash the company has in the bank.

The current liabilities are the short-term debts that need to be paid back over the next 12 months.

Thus the working capital is the balance for how much money the company has on its books.

But, as a rule of thumb, a junior miner should have enough working capital to be able to finance its operations at least 12 months into the future.

If they don’t find external financing, they will have to come to the market and get that financing.

Of course any method where you extrapolate the immediate past into the immediate future is associated with extraordinary uncertainty and as such inherently shaky.

But because we are only interested in a rough estimate of the company’s cash position we can do this.

Operational expenses

To get a firm grip on the costs that a junior miner is having for its daily operations we only need two items in the financial reports:

- Total revenue in the income statement
- Net operating income in the cash flow statement

As we mentioned above these items are audited by external auditors and cannot be easily manipulated.

Total revenue

As the name implies this is the total revenue or sum of the cash that comes into the company.

It does not include income from investment.

Neither does it include any bank account interests, capital gains or miscellaneous earnings such as fees.

It’s simply the sales of products and services that the company is selling.

The number for the total revenue can be found in the income statement of the financial report.

Net operating income and expense

The operating income is the income that is generated through a company’s operations.

Operating income is not the same as the total revenue and the two terms cannot be used interchangeably.

Interests paid or company taxes are not part of the operating income.

Operating income equals the total revenue minus operating expenses, like so:

$$\text{Operating Income} = \text{Total Revenue} - \text{Operating Expenses}$$

Because we are interested in the Operating Expenses, rearrangement of the equation will give this:

$$\text{Operating Expenses} = \text{Total Revenue} - \text{Operating Income}$$

These are the true, no nonsense, operating expenses that the company has.

This number has been checked and re-checked by the auditors and cannot be manipulated.

As you will see we will use it to calculate a rough estimate of the time it takes before the company files for bankruptcy without external financing.

This number will of course not be exact, but we will have an idea of the financial strength of the company.

The first thing we do is that we dig into the balance sheet of the financial statement.

We calculate the Working Capital that the company has.

As we mentioned above the Working Capital is given by the Current Assets minus the Current Liabilities.

These are also numbers that we can trust because they are audited.

Once the Working Capital is calculated we go to the Statement of Comprehensive Income and fetch the Total Revenue.

Equipped with this we turn our attention to the Cash Flow Statement and the item that says Net Operating Income.

Now that we have those two numbers we can calculate the Net Operating Expense.

We do it by subtracting the Net Operating Income from the Total Revenue.

Then we need to divide the Net Operating Expense with the reporting period to have an estimate of the monthly expenses.

Then by dividing our Working Capital with our monthly expenses we can figure out how many months our junior miner will stay in business.

As we mentioned above extrapolations like this are very uncertain, but they give us an idea of the financial strength of the company in question.

Of course we can do our calculations in Microsoft Excel, like so:

B13 =B9/B11

	A	B
1	Current Assets:	$500 000
2	Current Liabilities:	$225 000
4	Working Capital:	$275 000
6	Total Revenue:	$45 000
7	Net Operating Income:	$12 000
9	Net Operating Expenses:	$33 000
11	Reporting Period (months):	12
13	Net Operating Expenses per month:	$2 750
15	Number of months company is viable without cash injection:	100

Figure 18. Estimate of the time that a company can stay alive without additional financing.

Obviously these are made up numbers and should not be taken literally.

In the example above the monthly expenses are so low and the working capital so strong that the company will survive for 100 months based on this year's operational income.

That is unlikely to be the case for a struggling junior miner.

The financials

So now that we have laid out the terms involved we can get into the real discussion about investing in the mining business.

The starting point of valuing a resource project can be found in the Preliminary Economic Assessment or, at a later stage, in the Feasibility Study.

From the PEA or the FS we can derive an estimated cost for setting up the mine and the processing plant.

These costs will of course be higher for each year due to inflation.

As I write this in June 2015, the average costs for building a mine and a processing plant from scratch will be around 600 000 000 USD.

In accounting, the fancy name for these initial costs is *Front-end Capital Costs* (FECC) as opposed to *Operational Costs* which are costs during the operation of the mine.

As we discussed in the previous section the FECC will be subtracted from the Present Value to get to the Net Present Value while the operational costs are subtracted from each Cash Flow to get to the Net Cash Flow.

Thus, the formula looks like this:

$$\boxed{\text{Net Present Value} = \text{Present Value} - \text{Front-end Capital Costs}}$$

In the final step we need to add the Front-end capital costs to the Enterprise value and compare this figure to the Net Asset Value.

If the Net Asset Value then is greater than the sum of the Front-end capital costs and Enterprise value, then the project is undervalued at its current state in the market.

The formula looks like so:

Undervalued: Net Asset Value > Front-end capital costs + Enterprise Value

Of course this can also be calculated in Microsoft Excel as we will get into a little bit later in the examples.

One thing that is important to recognize is that these numbers all come from audited resources or reserves.

Although it may be tempting to invest in companies that have just made a discovery, it often proves futile to make money out of them.

The reason is that they have not yet defined their resource and even if new discoveries often are hyped in the market they are inevitably prone for market correction.

So unless your time horizon is not extremely short you are well advised to stay out of any kind of discovery that has just been made.

The only time that we would act on the news of a discovery would be to sell badly acquired junior miners.

So what do we do when the numbers are not as clear cut as in the examples below?

When we calculate NPV:s and rates of return, it is important to recognize that the final rate of return will be highly dependent on the metal price that we are using in our calculations.

As already mentioned, the Internal Rate of Return should be above 30% to make a resource project really worth investing in.

If it is below 25% we would probably be able to consider it with the caveat that we may have to adjust our metal prices.

In the coming examples we will use conservative numbers for our metal prices and not fall into the trap of believing that the future will be exceptionally rosy.

A rosy number may not be a problem in a market that is rising, but would be a problem if the market was going down.

Managements have a long history of over-promising and under-delivering which is the reason why we keep the metal price conservative in the first place.

If the metal price drops only 10%, the whole enterprise will be uneconomical and the company will have a hard time paying its bills.

Therefore it is important to look into the fundamentals of each discovery and carefully analyze its pros and cons.

But, of course, if the metal price keeps going up with 10% or even 15% a year as it did in the beginning of last decade money will pour into discoveries and the valuations will inevitably rise.

This illustrates why it is better being safe than sorry with your hard earned cash.

That being said it is also important to recognize that this is a market that rewards discovery.

Even in the adverse market conditions that we have had for the last few years – this text is written in June of 2015 – there have been examples of companies rising by 500% or more if they present decent discoveries.

So the situation is far from hopeless.

You only need to identify those discoveries that are viable and separate those from the ones that do not belong in the business.

Tax

One thing that is inevitable is taxes.

It is as true in investing as in life in general.

Tax rates will of course be dependant on the legislation where the mine has its head-quarters and its operations.

In some cases it will be very low and in others very high.

In the following examples we will use an average tax rate of 30%, but when you are on your own it is important that you look up the tax rate for that specific country.

This is one of the reasons it is important for managements to have specific knowledge about the legislation in which they operate as conditions may differ from country to country.

It is also a good idea to make one set of calculations without tax.

That way you will have an idea of the total value of the resource you are considering and can compare values pre tax and after tax.

Examples

I will now go through a couple of examples.

In the first example let’s consider a hypothetical junior mining company, XYZ.

The company has published a Feasibility study and is now raising capital for building copper mine.

The Feasibility Study defines the Proven reserves to be 1 000 000 000 lbs and the Probable Reserves to be 200 000 000 lbs.

However, in the Cash Flow analysis of the Feasibility Study, the company used an estimated future copper price of 3 USD per lb.

What would the resource be worth if we instead estimate the copper price to be 2.5 USD per pound?

Let’s plug these numbers into our Microsoft Excel template, like so:

	A	B	C	D
1				
2		Type	# of lbs	Valuation (USD)
3		Proven Copper Reserves	1 000 000 000	2 500 000 000
4		Probable Copper Reserves	200 000 000	500 000 000
5		Total Copper Reserves	1 200 000 000	3 000 000 000
6				
7		Total Metal Valuation		3 000 000 000
8				
9		Metal Price (USD/lb)	2.5	

Figure 18. Metal valuation of a junior miner, XYZ, with proven copper reserves of 1 000 000 000 lbs, probable reserves of 200 000 000 lbs and a copper price of 2.5 USD per lb.

Next let's consider an example of how to estimate cash flows from a Feasibility Study.

In a FS a junior miner estimate the size of a gold discovery to be 950 000 ounces.

The reserves are planned to be mined over a period of 10 years.

We will then arrive at annual production numbers of 95 000 ounces per year.

The annual operational costs will be 3 000 000 USD and the cost of building the mine will be 300 000 000 USD.

Furthermore, we estimate that the future metal price of gold will be 1000 USD per troy ounce.

Thus, the annual cash flows can be calculated in Microsoft Excel as:

	A	C	D	E	F
1	Est. annual prod. (oz/year):	95000			
2	Est. gold price ($/oz):	1000			
3	Annual Discount Rate:	0.1			
4	Annual operational costs:	-$3 000 000.00			
5	Cash Flow 0 (cost)	-$300 000 000.00		Period	Cash Flows
6	Cash Flow 1	$92 000 000.00		1	-$83 636 363.64
7	Cash Flow 2	$92 000 000.00		2	-$76 033 057.85
8	Cash Flow 3	$92 000 000.00		3	-$69 120 961.68
9	Cash Flow 4	$92 000 000.00		4	-$62 837 237.89
10	Cash Flow 5	$92 000 000.00		5	-$57 124 761.72
11	Cash Flow 6	$92 000 000.00		6	-$51 931 601.56
12	Cash Flow 7	$92 000 000.00		7	-$47 210 546.88
13	Cash Flow 8	$92 000 000.00		8	-$42 918 678.98
14	Cash Flow 9	$92 000 000.00		9	-$39 016 980.89
15	Cash Flow 10	$92 000 000.00		10	-$35 469 982.63
16	NPV = Value added to firm if project is undertaken	$265 300 173.72		Sum of discounted cash flows:	-$565 300 173.72

Figure 19. Estimated annual cash flows of a gold resource. The estimated annual production is entered in C1, the estimated metal price in C2, the discount rate in C3, the operational costs in C4, the cost of building the mine in C5 and cash flows between C6 and C15. Discounted cash flows (or Present Values) are then calculated and added together in F16. The initial investment is subtracted to arrive at the Net Present Value in C16.

As we can see in Figure 19, the figures may or may not differ from the estimates in the PEA or Feasibility Study.

It all depends on the numbers we put into our calculations.

If our estimation of the metal price is higher than the one used in the PEA or the FS then our numbers will be higher and similarly with a lower metal price.

In Figure 19, the Present Value is calculated in F16 and the Net Present Value in C16.

The Net Present Value is therefore the profit that we would expect from the project or enterprise.

From the calculations of the Net Present Value we will also be able to extract the Internal Rate of Return just like we did on page 79.

Again we do it by calculating the Net Present Value for different discount rates.

When the NPV is zero we have the Internal Rate of Return.

In Microsoft Excel it will look like this:

19		IRR	32%	
20		NPV Profile		
21		Annual RRR (Discount)	NPV: Accept	NPV: Reject
22		5%	$483 756 095.31	
23		10%	$323 673 561.23	
24		15%	$209 405 015.52	
25		20%	$125 535 916.68	
26		25%	$62 406 081.95	
27		30%	$13 791 259.15	
28		35%	-$24 423 156.40	-$24 423 156.40

Figure 20. The Net Present Value Profile using the same numbers as in Figure 14. Net Present Value for different Discount Rates (D22 to D28) is calculated and the IRR is determined (D19).

In the example the IRR is 32% which is well within the range of what we would consider a good investment.

However, if we for example use a metal price of 1000 USD per ounce we will get an IRR of 26% and a metal price of 900 USD we will get an IRR of 23% which would fall outside our criteria for a good investment.

Therefore, be careful when you determine your input numbers as all the subsequent models will depend on them.

Now that we have calculated the Net Present Value we also have a reasonable idea of the Net Asset Value.

Remember that the Net Asset Value is calculated as the NPV plus the company's assets minus its liabilities.

We can find the numbers for the assets and the liabilities in the company's annual report.

There we find that the company has current assets of 160 000 000 USD, current liabilities of 120 000 000 USD, non-current assets of 67 000 000 USD and non-current liabilities of 300 000 USD.

In Microsoft Excel the numbers then looks like so:

	A	B	C
1		Tax Rate	30%
2		Net Present Value at Discount Rate 10%	$565 300 000
3		Current Assets	$160 000 000
4		Current Liabilities	-$120 000 000
5		Non-Current Assets	$67 000 000
6		Non-Current Liabilities	-$300 000
7		Net Asset Value Pre Tax	$672 000 000
8		Net Asset Value After Tax	$470 400 000

Figure 21. The Net Asset Value of a company with a resource that has a Net Present Value as above. NAV pre tax is calculated in C7 and after tax in C8, respectively.

Please note that we also enter the tax rate in these calculations at this point.

Now that we have calculated the Net Asset Value of the company we now need to turn our focus to what the market is paying.

We do that by calculating the company's Enterprise Value.

Let's say that the assets and liabilities are the same as previously, the company has issued 1 00 000 000 shares, and that the current share price is 7.5 USD.

If we plug these numbers in Microsoft Excel it looks like so:

	A	B	C
1			
2		Current Valuation	$7.5
3		Number of shares outstanding	100 000 000
4		Market Capitalization	$750 000 000
5		Current Assets	$160 000 000
6		Current Liabilities	-$120 000 000
7		Non-Current Assets	$567 000 000
8		Non-Current Liabilities	-$400 000
9		Enterprise Value	$1 356 600 000

Figure 22. Enterprise Value (C9) if the current share price is 7.5 USD (C2), the company has issued 100 000 000 shares and the assets and liabilities are the same as in Figure 20.

We then add our calculated Enterprise Value to the Front-End Capital Costs, like so:

	A	B	C
1			
2		Enterprise Value:	$1 356 600 000
3		Front-End Capital Costs:	$300 000 000
4		Total:	$1 656 600 000

Figure 23. Enterprise Value (C2) and Front-End Capital Costs (C3) combined (C4).

We then compare this number to the Net Asset Value that we calculated in Figure 20:

6		Net Asset Value Pre Tax:	$672 000 000
7		Net Asset Value After Tax:	$470 400 001

Figure 24. Net Asset Value Pre Tax and After Tax.

If we compare these numbers with each other we see that the stock is currently 2.3 times overvalued Pre Tax and 3.5 times After Tax.

What this means is that the market is paying too much for stock for the time being.

We now want to calculate the payback period of this enterprise.

If we use initial costs of 300 000 000 USD and estimated cash flows of 92 000 000 USD it will look like this in Microsoft Excel:

	A	B	C
1			
2		Cost of Initial Investment	$300 000 000
3		Annual Cash Inflows	$92 000 000
4		Payback Period	3.3

Figure 25. Payback period when the initial costs are 300 000 000 USD and the estimated cash flows are 92 000 000 USD.

We then see that we arrive at a payback period of 3.3 years which falls out of the range for a good resource project.

Remember that we wanted a capital payback of 3 years or less.

In this example we would probably consider the investment if the price paid was three to four times lower, but as it now stands now (with a share price of 7.5 USD) it is overvalued in the market.

Key concepts

Cash Flow: A revenue stream that changes the cash account of a miner over time.

Current Assets: Are the assets on a company’s balance sheet that can reasonably be expected to be converted into cash over the next 12 months.

Current Liabilities: Is a measure for the debt that needs to be repaid over the next 12 months.

Discounted Cash Flow (or DCF): DCF is a valuation method based on future cash flows. The method uses a discount rate taking account of the time value of money.

Discount Rate: A rate that is used to calculate what future cash flows are worth today.

Dollar Cost Average: Dollar cost average is an investment method designed to average out price swings by investing a fixed sum each month in a given security.

Enterprise value (or EV): The EV is a hypothetical take-over price of a company.

Feasibility Study (or FS): is a more in depth analysis of both geology and economics of a resource.

Front-end Capital Costs (or FECC): Initial cost for setting up a mine and the infrastructure that go with it.

Earnings Before Interest, Taxes, Depreciation and Amortization (or EBITDA): is an accounting term used to determine the relative profitability of a company.

Internal Rate of Return (or IRR): The IRR is the hypothetical Discount Rate at which the Net Present Value is zero.

Net Asset Value (or NAV): The NAV of a company is the sum of the individual Net Present Values for different projects minus their liabilities.

Net present value (NPV): The NPV is the value of the future cash flows minus front-end capital costs. It is used to calculate the profitability of a project.

Net Operational Costs (or OC): The Operational Costs are the costs that will occur during the operation of a mine. They are defined by the Total Revenue minus Net Operational Income.

Net Operational Income (or OI): The Net Operational Income is the income that a company generates during its operations. It can be defined as the Total Revenue minus Net Operational Costs.

Payback Period: The payback period is time it will take to recover the initial costs of an enterprise.

Preliminary Economic Assessment (or PEA): is an assessment of the economy of a resource.

Present Value (or PV): The PV is the sum of the discounted cash flows in DCF-analysis before subtracting the initial costs (or FECC).

Reserves: are defined as Proven and Probable in the Feasibility Study.

Resources: are defined as Measured, Indicated or Inferred in the Preliminary Economic Assessment.

Total Revenue: Is the revenue that an entity receives from product or service sales.

Working Capital (WC): The WC is difference between a company’s Current Assets and its Current Liabilities. It measures a company’s ability to pay for its operations.