[SQUEAKING] [RUSTLING] [CLICKING]

RICHARD DE NEUFVILLE: What can we expect to achieve. So the evaluation has many dimensions. It is uncertainty. Best is not defined. What we can do first is to dominate, to screen out the dominate solutions. As we can go through a process and say, of the 1,000 different solutions or the 10 different solutions, eight of them, for example, are of good. And there is a dominant three or four or five that are the dominant ones. I'll give it a graph of this.

And then, we want to recognize that if we're talking about individuals, they must have a trade-off in some way between risk and reward, is one way to think about it. And groups basically have to negotiate in some way a deal to get things going. You might say that the factory owners are the bosses that rule.

But as you know from experience that the workers have something to say, they may not have that much power. But if they go on strike, the factory owners just can't tell them everything. So there is, in some ways, whether it's explicitly or implicitly, there is typically some kind of negotiation between what individuals might prefer or groups might prefer to what they actually get.

So the first thing to look at is this concept of dominance. That is, if we look at two axes of benefits, we can think of a locus or the dominant ones. There are various solutions that represent an amount of one axis and one or the other one. And there are all kinds of other possible solutions interior to this space so that this point where my arrow is, right at the point of the arrow, we could agree there are solutions that are better on all counts.

That is, this particular xy point, there are points which have the same y, but better x or the same x and better y. And so that they are better solutions. So the ones in here are inferior. And we don't want to consider them.

So the first thing to do is to try to focus on the dominated data. Get out of the dominated alternatives and look for the dominant ones, the ones that are on the frontier. And I would quickly say that expected value by itself is just one measure. And we've emphasized that. So for implicitly emphasized it as a meaningful way to talk about distributions. But it's only one of the possible ones. And we need to go beyond that.

So other dimensions are, for example, the worst that could happen. And people are typically risk averse, don't like it and sensitive loss so that they are looking at the good value on average. But maybe consider about the downside.

On the other hand, you may also be considering the upside. So that you know most startups will fail. But the reason you're in them is because if you hit it big, it'd be life-changing, and therefore, although the expected value for a startup is not positive, that it might make a difference. And that's why you do it. So the downside, the upside.

The capital expenditure may be important. How much do I have to put in to get this? You might have some measure of benefit cost. I'm simply saying that there are many dimensions besides an expected value.

One of them is it's a very common one you should know is this notion of value at risk. And it reflects in a standard way the lowest 5% or 10% of a distribution, the tails of distribution, and is a standard concept in finance that they will often, banks and others will be interested in saying, well, what's the worst going to happen?

How probable it is that this company is going to have a big loss or this borrower is going to have a big loss and is not going to be able to repay us. So they are interested, not only how good it can get, that's fine, but they want to get their money back. And they're concerned with what's the downside. So they might want to have this figure of what's the value at risk, either at the 5% or 10% level.

Conversely, you can talk about the value in gain. This is not a well-established notion but it's important. In fact, my colleagues and I have set this up as a counterpart. It's sort of as a way of balancing off the equation, so to speak. And, of course, the investors are mostly interested in that. Why am I going to a startup? Well, because it might pay off really well.

Then, the notion that we use a law that you've seen it, and you've seen it in the garage case, is this notion of a target curve. Says the distribution of outcomes. I particularly like the cumulative distribution, but some others like a frequency distribution. But it's the distribution. And it goes from the worst case to the best case. And you can see, read from it the value at risk and the value in gain.

So if we looked at these curves, which were done in conjunction with some studies from BP by Jijun Lin when he did his PhD with us, that here at the cumulative probability and the benefits of this project and billions of dollars, as it was, it was fun to play with that kind of money, they value at risk at 10% level was a net PV of about a million for the original design, a million-plus for that 5% level it was a loss. And so that you can read off those extremes fairly easily.

Now, small question. If the target curve is always to the right of another, does it dominate? That is, if you have this black line, which represents one design, it's always to the right-- it is in the positive direction to the green line-- does that mean that a design represented by the black line will always be better than the design represented by the green line?

Now, the obvious reaction is, well, yeah. It's always to the right so how could it not be? The thing is that the situation that may be bad for this design, that is, that occur for these low returns here, may be exactly what's good for the other one. So that although overall the distribution for the green line is inferior to that for the black line, they are cases where the bad performance of this design are the situation where there's a good performance for another line.

You can imagine it easily that you're having a gold mine, and you're digging in one direction or another. And it could happen that the choice that was great for one case was the bad one for the other case. So it's possible. Just a subtlety to alert you to.