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RESEARCH NOTE **UNDERSTANDING METRICS:** **NPV VERSUS ROI**

THE BOTTOM LINE

Net Present Value (NPV) and Return on Investment (ROI) are two valuable metrics with different uses. ROI is a comparison metric appropriate for assessing a technology investment, while NPV should not be used for comparing projects or assessing project viability. Without an accurate estimate of residual value, the NPV result will be artificially low.

Net Present Value (NPV) and Return on Investment (ROI) are commonly used by financial professionals to assess project viability. It is important to understand the strengths and weaknesses of these two metrics and in particular why the assessment of a technology investment would result in a negative NPV and a positive ROI. There are three situations when an assessment could have a negative NPV and positive ROI: The ROI is lower than the cost of capital, the initial project cost is very high, and the benefits are achieved later in the 3-year assessment period.

NET PRESENT VALUE

Net Present Value (NPV) is the value today of a stream of payments given a particular interest rate. Put simply, \$100 today is worth more than \$100 a year from now because the \$100 received today can be placed in the bank to generate interest over the course of a year. At an 8 percent discount, or interest, rate, \$100 today is the same as receiving \$108 in a year. NPV allows you to calculate the current value of money received at a future date so the NPV of \$108 at 8 percent received in a year is equal to \$100 today. NPV can also be used to calculate the total value today of a stream of payments received over multiple future years.

In a technology investment the stream of payments typically includes a large up-front cost followed by annual benefits in subsequent years. The challenge with applying NPV to a technology investment is the inaccuracy in estimating the residual value of the technology. To calculate NPV properly a salvage value must be included at the end of the period. In the example above, if \$100 is spent in the initial year and \$8 received at the end of the first year the NPV at 8 percent will be \$8 brought back 1 year at 8 percent or \$7.41 less the \$100 initial investment or negative \$92.59. Without an estimate of a residual value, difficult at best with a technology investment, the NPV will always be inaccurate.

It is important to realize that Net Present Value is a technique for moving cash flows to a common point in time and it is not a comparison metric. It is a useful

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tool for normalizing costs and benefits but it should never be used for assessing the viability of a project. In limited cases NPV can be used to make a no-go decision but only with an accurate estimate of the project's residual value and only with the understanding that the calculation is highly sensitive to the interest rate and gives no indication of the magnitude of investment.

In general the use of NPV should be avoided when assessing technology.

RETURN ON INVESTMENT

Return on Investment (ROI) is the effective interest rate returned by the cash flows in the project. It is the net benefit divided by the initial cost. In the example above, the \$100 investment returns \$8 at the end of the first year, yielding an ROI of 8 percent. This metric can be directly compared to other projects, the cost of capital, and the option of simply putting the money in a CD at the bank.

Since technology investments tend to exhibit variability in benefits achieved during the first few years a useful technique is to average the benefits over the first three years then divide by the initial cost. This calculates an effective average ROI over the first three years. In the example, if the project returned \$7 in year 1, \$8 in year 2, and \$9 in year 3, the effective average ROI would still be 8 percent.

ROI is the primary metric to use when assessing a technology investment.

NPV AND ROI?

One mistake often made is applying NPV to the annual benefits before calculating ROI. It is not correct to apply NPV to these future benefits since ROI is itself the calculation of the return. Consider the interest rate provided by a bank CD over a multiple year period. \$100 invested in an 8 percent CD would return \$8 each year and the amount would not increase.

NEGATIVE NPV WITH POSITIVE ROI

There are three situations when the NPV calculation for an investment would be negative while the ROI calculation is positive:

- First, NPV does not include a residual value so the result will always be artificially low. Adding back the initial cost may provide a better indication of the project's viability.
- Second, the actual return on the project may be lower than the cost of capital, resulting in a negative NPV. A project with a 5 percent ROI in an organization that faces an 8 percent cost of capital does not deliver enough of a return to justify the project's implementation. In all cases the ROI must be greater than the cost of capital to calculate a positive NPV. Comparing ROI to the cost of capital is a direct way to assess this situation, rather than trying to interpret the NPV result.
- Finally, since the ROI for technology is calculated as an average value over a 3-year period, instances where substantially higher benefits are received in the third year will increase the average. The ROI is correctly calculated, and, if above the cost of capital, does indicate a viable project; however, the NPV may

be negative. This is because the benefits from the third year have a much lower impact when discounted back to the start year.

CONCLUSION

NPV is an effective tool for moving cash flows to a common time point but it is often incorrectly applied as a comparison metric. Its primary flaw is that without an accurate residual value estimate, the NPV will always calculate incorrectly low. Since residual value is difficult at best to estimate with technology investments, NPV should never be used for assessing these investments.

ROI is an accurate assessment of a project's value and its result can be directly applied to other projects and to the cost of funds. ROI remains the primary metric for use in assessing a technology project's value.

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