**ROI Guide: Net Present Value**

Computerworld - **Definition:** The net present value (NPV) of an investment is the present (discounted) value of future cash inflows minus the present value of the investment and any associated future cash outflows.

**What it means:** It's the net result of a multiyear investment expressed in today's dollars.

**Strengths:** By considering the time value of money, it allows consideration of such things as cost of capital, interest rates and investment opportunity costs. It's especially appropriate for long-term projects.

**Weaknesses:** Ranking investments by NPV doesn't compare absolute levels of investment. NPV looks at cash flows, not at profits and losses the way accounting systems do. NPV is highly sensitive to the discount percentage, and that can be tricky to determine.

Unlike the more widely used payback period, NPV accounts for the time value of money by expressing future cash flows in terms of their value today. It recognizes that money has a cost (interest), so that you would prefer to have $1.00 today to having $1.00 a year from now. If you earn 10% interest on your money, $1.00 today will be worth $1.10 a year from now. Or, turning that around, the "present" value of $1.10 one year out is $1.00.

You probably wouldn't want to make an investment that's estimated to produce a negative NPV. The bigger the NPV—other things being equal—the more attractive the investment is.

Computing NPV requires use of a discount rate equal to some minimum desired rate of return. This could be your company's average weighted cost of capital (debt and equity) as computed by your finance department. If capital costs your company 10%, you aren't likely to invest that capital for an 8% return. Unfortunately, computing the cost of capital can be difficult and controversial.

The discount rate (say, 10%) determines the discount factor for each year (say, .909) that is applied to that year's cash flow to convert it to today's dollars. The discount factor for year *n* can be computed as: discount factor = 1/(1+i)n, where *i* is the target rate of return. So at a discount rate of 10% in Year 1, discount factor = 1/(1.1), or .909. Thus, in the earlier example, the present value of $1.10 a year from now is $1.10 x .909, or $1.00.

Fortunately, this math is automated in spreadsheet packages. You enter only the undiscounted cash flows, the years in which the flows are expected and some target interest rate. NPV will pop out.

The chart below compares two projects that a bank could undertake. Each has an initial investment of $1 million and a minimum desired rate of return of 10%. On the basis of absolute (undiscounted) return, the ATM installation is better because it generates $250,000 more cash over the life of the investment. But when the time value of money is considered, the server consolidation project looks slightly better, with an NPV higher by $9,000. Its present value is higher because the returns occur earlier in the project's life.

Gaylord Entertainment Co., a Nashville-based hotel and resort company, relies on relatively simple measures such as payback period to evaluate investments of less than $100,000. Between $100,000 and $500,000, it also looks at discounted cash flow (DCF). "And above $500,000, DCF is absolutely necessary," says CIO Kent Fourman.

The yearly cash flows from a hotel or entertainment project are net revenues, but for an IT project, they generally are cost savings, Fourman says. But he says NPV isn't appropriate for an IT project that can't be associated with clearly defined cash flows.

"We are doing [Windows 95](http://www.computerworld.com/action/inform.do?command=search&searchTerms=Microsft+Windows+95) to [Windows 2000](http://www.computerworld.com/action/inform.do?command=search&searchTerms=Microsoft+Windows+2000) and XP conversions, for example, and you're not going to come up with a traditional DCF on that kind of project," Fourman says. "There are benefits that are not necessarily financial in nature."

NPV has some flaws, says Ian Campbell, chief research officer at [Nucleus Research Inc.](http://www.computerworld.com/action/inform.do?command=search&searchTerms=Nucleus+Research+Inc.) in Wellesley, Mass. He offers an example in which two investments each have an NPV of $100, but one involves an initial investment of $1,000 and the other an investment of $1 million. Clearly the $1,000 investment is preferable because it's less risky and ties up less capital, he says.

But, Campbell adds, NPV is a good "no-go indicator," because you'd normally reject an investment with a negative NPV without further consideration. Those with a positive NPV should then be measured by other yardsticks, he says.

|  |
| --- |
| http://www.computerworld.com/computerworld/images/1by1.gif |
|

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Net Present Value: What It Looks Like**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **ATM installation** | **Server consolidation** |
| **Year** | **Discount factor (at 10%)** | **Cash flow** | **Present value of cash flow** | **Cash flow** | **Present value of cash flow** |
| 0 | 1.000 | -$1 million | -$1 million | -$1 million | -$1 million |
| 1 | 0.909 | +$500,000 | +$454,500 | +$1 million | +$909,000 |
| 2 | 0.826 | +$500,000 | +$413,000 | +$750,000 | +$619,500 |
| 3 | 0.751 | +$500,000 | +$375,500 | +$500,000 | +$375,500 |
| 4 | 0.683 | +$500,000 | +$341,500 | http://www.computerworld.com/computerworld/images/1by1.gif | http://www.computerworld.com/computerworld/images/1by1.gif |
| 5 | 0.621 | +$500,000 | +$310,500 | http://www.computerworld.com/computerworld/images/1by1.gif | http://www.computerworld.com/computerworld/images/1by1.gif |
| **Total** | **+$1.5 million** | **+$895,000** | **+$1.25 million** | **+$904,000** |

http://www.computerworld.com/computerworld/records/images/site/black_bullet.gif**NPV considers the time value of money.** In this example, we compare two $1 million projects with a minimum desired rate of return of 10%. On the basis of simple cash flow, the ATM installation looks better because it generates $250,000 more over the life of the investment. But when the time value of money is considered, the server consolidation project looks slightly better, with an NPV higher by $9,000, because the returns occur earlier in the project's life. |
|

 |

**ROI Guide: Internal Rate of Return**

|  |
| --- |
|  |
|

|  |
| --- |
|  |

 |

**February 17, 2003** [(Computerworld)](http://www.computerworld.com) -- **Definition:** The internal rate of return (IRR) is the discount rate that results in a net present value of zero for a series of future cash flows.

**What it means:** It's a cutoff rate of return; avoid an investment or project if its IRR is less than your cost of capital or minimum desired rate of return.

**Strengths:** It provides a simple hurdle rate for investment decision-making. It's the method favored by many accountants and finance people, possibly the ones at your company.

**Weaknesses:** It's not as easy to understand as some measures and not as easy to compute (even Excel uses approximations). Computational anomalies can produce misleading results, particularly with regard to reinvestments.

IRR is the flip side of net present value (NPV) and is based on the same principles and the same math. NPV shows the value of a stream of future cash flows discounted back to the present by some percentage that represents the minimum desired rate of return, often your company's cost of capital.

IRR, on the other hand, computes a break-even rate of return. It shows the discount rate below which an investment results in a positive NPV (and should be made) and above which an investment results in a negative NPV (and should be avoided). It's the break-even discount rate, the rate at which the value of cash outflows equals the value of cash inflows.

Consider the three scenarios shown here (see table), each involving an initial investment of $1 million. The investment returns $300,000 (undiscounted) per year in each of the five years after the initial investment, for a net return of $500,000.

A company evaluating this investment using cash flow discounted at 10% would compute an NPV of $137,000, a decent but not spectacular result. But if the company evaluates the same investment at 15%, the project has a present value of only $6,000, essentially just breaking even, and at 20% the project's present value is negative. The IRR is a fraction of a percentage point above 15%; at that discount percentage, the investment's NPV is zero.

IRR is often used as a hurdle rate, a sort of go/no-go investment threshold. Gaylord Entertainment Co. in Nashville, for example, has computed its weighted average cost of capital—a percentage that it won't disclose—and a "hurdle" percentage rate a few points higher. An investment's IRR must generally equal or exceed the hurdle rate to be approved by management, says CIO Kent Fourman.

"We calculate the IRR and then compare that to our hurdle rate," Fourman says. "And we compare that IRR against every other [project's] IRR, because you always have limited cash."

But the IRR cutoff isn't an absolute test, he says. For example, management's subjective assessment of risk may influence an investment decision, he says. "But if you can't show that IRR exceeds our hurdle rate, then you'll have to have a lot of the soft justifications to get it approved," Fourman says.

Not everyone is as enthusiastic about IRR. Like NPV, it doesn't measure the absolute size of the investment or its return. And because of the way the math works, the timing of periods of negative cash flow can affect the value of IRR without accurately reflecting the underlying performance of the investment.

IRR can also produce misleading results because, as classically defined, it assumes that the cash returned from an investment is reinvested at the same percentage rate, which may not be realistic. That error is magnified when comparing two investments of different durations. Some software, such as [Microsoft Excel](http://www.computerworld.com/action/inform.do?command=search&searchTerms=Microsoft+Excel), will compute an optional "modified IRR" that allows the user to specify a different reinvestment rate.

IRR becomes increasingly misleading the more it diverges from the cost of capital, says Ian Campbell, chief research officer at [Nucleus Research Inc.](http://www.computerworld.com/action/inform.do?command=search&searchTerms=Nucleus+Research+Inc.) in Wellesley, Mass. "IRR is a terrible metric, and it should never be used," he asserts.

The key metric for IT projects, Campbell says, is payback period, because it favors short-term, and hence less risky, projects that IT should be doing.

|  |
| --- |
| http://www.computerworld.com/computerworld/images/1by1.gif |
|

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Internal Rate of Return: What It Looks Like**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **Discount rate: 10%** | **Discount rate: 15%** | **Discount rate: 20%** |
| **Year** | **Cash flow** | **Factor** | **Amount** | **Factor** | **Amount** | **Factor** | **Amount** |
| 0 | -$1 million | 1.000 | -$1 million | 1.000 | -$1 million | 1.000 | -$1 million |
| 1 | +$300,000 | 0.909 | $273,000 | 0.870 | $261,000 | 0.833 | $250,000 |
| 2 | +$300,000 | 0.826 | $248,000 | 0.756 | $227,000 | 0.694 | $208,000 |
| 3 | +$300,000 | 0.751 | $225,000 | 0.658 | $197,000 | 0.579 | $174,000 |
| 4 | +$300,000 | 0.683 | $205,000 | 0.572 | $172,000 | 0.482 | $145,000 |
| 5 | +$300,000 | 0.621 | $186,000 | 0.497 | $149,000 | 0.402 | $121,000 |
| **Total** | **+$500,000** | **NPV = +$137,000** | **NPV = +$6,000** | **NPV = -$102,000** |
|  |  | **IRR = slightly more than 15%** |

http://www.computerworld.com/computerworld/records/images/site/black_bullet.gif**IRR is often used as a hurdle rate, a sort of go/no-go investment threshold.**In this example, there is an initial investment of $1 million, with a net (undiscounted) return of $500,000. The NPV of the $1 million outlay depends on the discount rate, or cost of capital, used to evaluate the investment. The NPV is zero at the IRR, here a fraction of a percentage point above 15% |
|

 |