

Project Schedules and Return on Investment
Alex S. Brown, PMP
Strategic Planning Office Manager, Mitsui Sumitomo Insurance Group, USA

Introduction

Often project managers and schedulers are isolated from business decisions relating to their projects. Top-level decision makers are typically concerned not just with cost and time, but with payback periods and return on investment (ROI). Only a few project management authors and speakers have addressed these issues (Heerkins). This paper explains the critical role that schedule plays in determining the break-even point and ROI for any project.

Time Value of Money

The business concept of “time value of money” is essential to understanding the impact of schedule on payback and ROI. Many business-oriented web sites, business books, and introductory financial textbooks contain excellent explanations of the formulas and methods used to calculate time value of money. A project manager can work with an accounting or finance professional for the calculations, but there are certain concepts the project manager must understand.

At its core, time value of money demonstrates that money available today is worth more than money available later. A dollar today is worth a dollar, but a dollar in a year is worth less than a dollar. Loans, bonds, certificates of deposit, and many other financial instruments use the formulas to determine the correct price today for a stream of payments in the future. See Exhibit 1 for an illustration of the relationship of time, money, and rate of return.

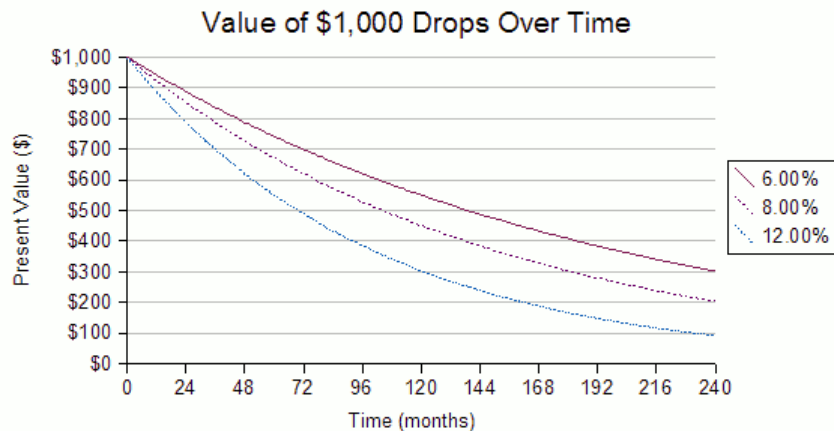


Exhibit 1: Over time, the value of money diminishes. The higher the prevailing rate of return, the faster the value drops.

This paper uses dollars as the currency in all examples, but the same relationships hold with any currency in the world. When using other currencies, substitute the local currency symbol for the dollar sign and use rates of return that correspond the local currency markets.

Why Worry About Time Value of Money (TVM)?

It is possible to do business analysis without TVM, but the results will be distorted. Bankers, investors, and most business decision-makers need to see the effect of time on their investment. The main reason is financing costs. If they need to supply money today to get a stream of money in the future, they need to consider financing costs between the time they invest and the time they receive their return.

What is a Dollar Tomorrow Worth in Today's Dollars?

The best way to perform any time-value-of-money calculations is to turn them over to people who understand them well. Typically an accounting or finance group will have all the information and training to analyze the project cash flows and calculate solid financial measures. Before presenting financial forecasts to senior management, always

consult with them. They will know the measures, forecasts, and report formats that management finds most useful, and will provide management with confidence that the forecasts have been properly prepared.

The project manager may want to perform some initial forecasts on his or her own. Common spreadsheet functions can calculate these measures:

Spreadsheet Function Name	Application
PMT	Calculates the regular payment needed to go from a current value to a future value. Often used to figure out the monthly payment for a mortgage or loan.
PV	Calculates the present value of a future cash flow, either a single payment at a future date, or a stream of future payments, or both.
FV	Same as PV, but calculates the future value.
NPER	Calculates the number of payment periods needed to go from a present value to a future value, given a rate of return. Optionally, can include a regular payment or withdrawal. Used to calculate the length of a loan or mortgage, given the balance and payment amount. Also useful to determine the time needed to pay back an investment.

See your spreadsheet software's documentation for full details about how to use these functions. Many other functions are available to calculate other financial measures, but these are core, frequently-used functions.

All these functions require an interest rate or rate of return. For business plans, companies often use a standard, expected rate of return. This number may come from the investment markets or the company's own expected rate of return on cash and other investments. Some companies have an expected rate of return for any new investment, and use that to discount any future cash flows in their business plans. Even non-profit organizations should have an expected rate of return on cash. Talk to the financial experts at your company to get the right rate.

TIP: Most rates are stated as yearly rates. The formulas above deal with periodic rates, and will give the wrong results when yearly rates are typed in. For instance, when calculating a monthly cash flow, divide the yearly rate by twelve; for a weekly cash flow, divide by 52. Have someone double-check your formulas, because mistakes are very easy to make.

If your company has a more sophisticated view of their financial future, they might have a variable expected rate of return. They may forecast a different rate for one year, two years, and ten years in the future. Calculating TMV for variable rates is possible, but beyond the scope of this article. Work with the financial experts at your company to develop worksheets for variable-rate calculations.

What Effect Does Rate Have on the Business Plan?

The expected rate of return can have a dramatic impact on the profit or loss of a project. An investment may be attractive when the cost of cash is only 6%, but unattractive when the cost of cash is 12%.

This table shows the present value of future cash flows at 6%, 8% and 12% interest rates:

Cash Flow	At 6%	At 8%	At 12%
\$100,000 one year from now	\$94,190.53	\$92,336.15	\$88,744.92
\$100,000 two years from now	\$88,718.57	\$85,259.64	\$78,756.61
\$1,000 per month for the next 12 months	\$11,618.93	\$11,495.78	\$11,255.08
\$1,000 per month for five years	\$51,725.56	\$49,318.43	\$44,955.04

Most people wish for a high rate of return, when they are investing or looking for return on their deposits. When doing a business plan, lower rates are an advantage. The higher the rate, the less valuable future cash flows become. The higher the rate and the further in the future the cash flow is, the less valuable it is in today. In other words, the easier it is to generate a large return on cash today, the greater return needed to justify an investment.

Schedules and Return on Investment

Time value of money has critical and sometimes unexpected impact when schedules change. For business sponsors and schedulers to work together effectively, it helps for them to understand these relationships.

When a Schedule Delay Makes a Project Cheaper

Generally project schedulers and project managers are trained to complete every task in a schedule as quickly as possible. Any delay, particularly one that delays the overall end date, is seen as a defeat. Often there is a tension between the project team and the sponsor over schedule. The team wants decisions, authorization, and answers now to make fast progress, while the sponsor may delay these items. Depending on the project, a delayed schedule can actually make the project cost less. Delaying decisions and work not only gives the sponsor more time to gather business intelligence and make better decision, it actually reduces the cost.

Time value of money (TVM) is directly responsible for this effect. Project expenses incurred today are more expensive than the same expenses incurred a month or a year later. If a project manager takes a \$180,000 project and accomplishes it in 12 months, at an average monthly cost of \$15,000, the cost in today's dollars is about \$174,284. Spreading that same cost over 18 months, reducing the average monthly cost to only \$10,000, reduces the cost in today's dollars to \$171,728, a difference of over \$2,500 or about 1.5%. Both examples assume a yearly rate of 6%; a higher rate would result in a higher difference. While a 1.5% difference in project cost is not enormous, it can be enough to significantly change the business case for some projects.

Projects which are required for regulatory compliance, but which do not have clear penalties or deadlines often suffer from delays, and TVM effects sometimes explain the delays. Without a clear deadline and without a clear return to the organization for completing the effort, the business sponsor has a huge incentive to delay project costs. By pushing project costs from one financial year into the next, some sponsors may be able to achieve financial goals for their unit, resulting in cash compensation and other types of bonuses. A project manager or scheduler trying to fight delays in this environment may find strong resistance from the sponsor or other business stakeholders.

How Project Managers Can Leverage TVM

One of the greatest benefits of project management to a business person is the ability to invest very little at the start of an effort, create a detailed plan, and deliver results faster once investment begins. A project manager or scheduler can leverage time value of money by purposely delaying high-cost work as late as possible in the schedule. Because of the diminishing value of money over time, the delayed investments cost less to the organization.

There is a risk to balance when delaying investments, though. A common technique to reduce schedule risk is to front-load all work, getting as much work as possible done as soon as possible. That scheduling approach is useful when it is critical to make a deadline. Each deliverable and accomplishment completed early is another schedule risk eliminated.

Rather than assuming that the project end-date must be protected at all costs, the scheduler or project manager should discuss scheduling strategies with the sponsor. Front-loading the schedule is appropriate if the goal is to reduce schedule risk and finish as early as possible. Back-loading the schedule is appropriate if the goal is to reduce financing costs. Back-loading increases schedule risks, though, and sponsors need to understand the risks.

Project management generally has a positive effect on financing costs for a project, because it encourages up-front planning. While a poorly-planned effort might start making large investments in materials and labor at the very start, a well-planned effort will generally spend significant time on planning at the start. Although some business people

may become frustrated, asking, “Why isn't anything getting done?” this planning phase allows the team to make purchases and perform work in a more efficient, coordinated way. By delaying investments, the costs are spent close to the time that the project starts delivering value. That pattern of spending reduces financing costs and makes it easier to achieve a positive return on investment. Business people who are frustrated by apparent lack of progress during the planning phase may be able to understand its benefits when they understand that it creates slower-starting and faster-progressing project team.

Measuring Return on Investment and Payback

Real projects have business cases based on more than time-value-of-money considerations. The full business case often includes

- Return on investment
- Payback period

Return on Investment

Return on investment (ROI) is a calculation of the rate of return for a given investment for a given period of time. For example, a \$10MM investment to build a commercial property might generate an expected return on investment of 8% in the first 10 years. There are a variety of ways to calculate ROI, but generally that would mean that the property would return an average of \$0.08 annually for every dollar invested, in addition to paying back the initial investment. Some organizations express the ROI as a total return, not yearly. In this case an 8% ROI might mean that it is expected to return \$10.8MM after 10 years, 8% above the \$10MM investment. These returns can be calculated using present-value of all future cash flows, but often they are calculated without considering time value of money.

No matter how they are calculated, the goal is typically to compare the project ROI to the rate of return available through alternative investments. A project with an ROI of only 2% is very unattractive if the financial markets would pay a 3% rate of return for a low-risk investment like a corporate or government bond. Projects typically carry extra risks, and the ROI is a way to compare the project investment to other well-understood risks available in the financial markets.

There are many ways to calculate ROI, and spreadsheet functions like RATE and IRR can help perform the calculation. These calculations should be performed with the help of a financial professional, to ensure that the calculation will return a result that is comparable to the benchmark value that the project is being compared against. Different financial instruments and different organizations calculate rate of return differently, and can result in significantly different results given the same cash flows.

Payback Period

Another common financial measure is payback period. This measure is simpler to understand and calculate than ROI. The payback period is the measure of time until the total cash or benefits received for the project equal or exceed the total costs. The cash received and the costs can be discounted using TVM calculations, or they might be calculated on a raw cash basis. Some projects may generate a large ROI, but only after a long payback period. Some companies avoid these projects, preferring efforts that achieve a break-even point quickly, even if the potential long-term return is smaller.

Calculating payback period is relatively straightforward. Create a list of all cash flows for the project, either incoming or outgoing, from the start of the project. Typically the project will spend money while it is executing, and generate money once the benefits are delivered. List incoming and outgoing money into the future in time sequence, until the two are equal; at this point in time the original investment has been paid back. The time from the start of the project until payback is achieved is the “payback period”. Use TVM-adjusted cash flows to get a more sophisticated view of payback period, considering the cost of financing.

Sample Business Cases and Schedule Effects

Business cases contain estimates of revenue and profit over time. The expected cash flows, and the effect of schedule on them, is of critical importance. Issues such as “first to market” advantage, cost of financing, and penalties drive decisions on many projects.

Accelerating a Construction Schedule

A critical factor to the profitability of a construction project is getting the facility occupied on time, so that rental income starts as soon as possible. A project manager may even try to improve the profitability by completing the effort early, in the hopes of securing an additional month or two of rent. Not every dollar of extra rent can be considered additional profit, however.

An 18-month, \$10MM construction project with a S-shaped spending curve could have a present-value cost of about \$9.5MM at a 6% rate of return. Assuming that the resulting property will clear \$200K of income each month, the full \$10MM investment will be recouped 68 months after construction begins. Taking into account time-value-of-money, the payback would be between month 78 and 79 (see Exhibit 2).

Assume the project manager has the opportunity to complete the project for the same cost in 17 months instead of 18 months. A few tenants are willing to occupy the facility early, and will pay a total of \$50,000 in extra rent that month.

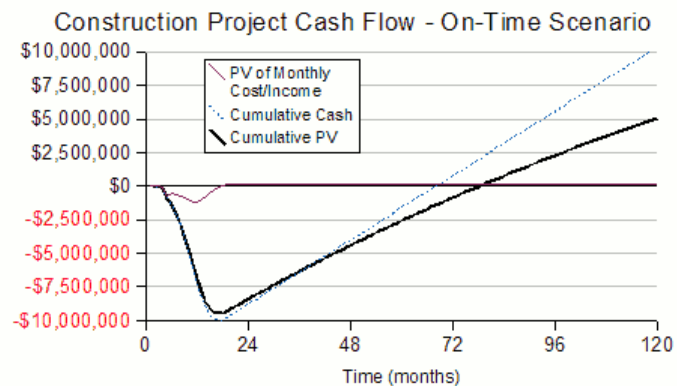


Exhibit 2: Cash Flow for on-time delivery shows cumulative cash and present value

On a simple cash basis, it would seem that this change would increase the profit of the project by \$50,000. Factoring in time value of money makes the calculation more complex. With the accelerated schedule, even with the same total cash cost, the project becomes almost \$35,000 more expensive at the end, because cash is spent more quickly throughout the project. There is a net benefit to the project profit, but it is closer to \$15,000 than \$50,000. At a higher cost of cash or at a lower early-occupancy rate, the early finish could be more expensive than the extra income.

The project manager can work with the sponsor to estimate cash flows for different scenarios, including early finishes and late finishes of different durations. Sometimes projects can generate income when they are only partially complete, such as when a single building in a complex is ready for occupancy. In real-life situations, penalties for late delivery, lost tenants, contractual requirements and other issues can dramatically change the business impact of schedule changes. Discussing cash flow in different scenarios can be a great way for project managers and sponsors to build a common understanding of the choices and alternatives available.

First-To-Market Advantage

With high-technology products, the pricing and profit of a product can change greatly over time. The first company to market a solution to a specific problem can charge an extremely high price for a time. Once competitors can produce similar products, the price quickly plummets. Competition drives the price from “what the market will bear” down to “what it costs to manufacture” with amazing speed.

The industries of computer software or computer processors provide many examples. The fastest, most advanced microprocessor will sell for \$1,000 or more, yet months later faster alternatives are available and that same part will sell first for \$500, then for \$100, and finally be made obsolete. In software, an advanced piece of software may sell for several thousand dollars in a “pro” version, but similar software with fewer features may sell to consumers for

less than \$100. “Advanced” features are introduced first in the pro versions, but soon become standard offerings in the consumer version. Often competition is at the heart of these pricing decisions, and time-to-market determines whether the price of a product is closer to \$100 or \$1,000.

For projects that create these products, schedule is of critical importance. Beating a competitor to market allows the company to sell the product for as long as possible at a high price. Often there is a limited market at a high price, and having the product in the market longer will increase the number of units sold and the total profit.

Modeling these markets accurately is complex and difficult. A simplified model can illustrate the critical trends and issues involved in scheduling these projects.

A software-development company estimates that their product could be sold to up to 10,000 people for \$1,000 per person for the next twelve months. After 12 months, a competitor will produce a similar product. With both products in the market, prices will drop to \$250. At that price, the potential market grows to 20,000 people. Twelve months later, the product will be available from many vendors, and prices will sink to \$100 but the potential market will only grow slightly to 25,000. Twelve months after that, the product will not be marketable and will need to be replaced by a new upgrade. The company marketing department believes that in any month they have product, the company can sell to 5% of the available market.

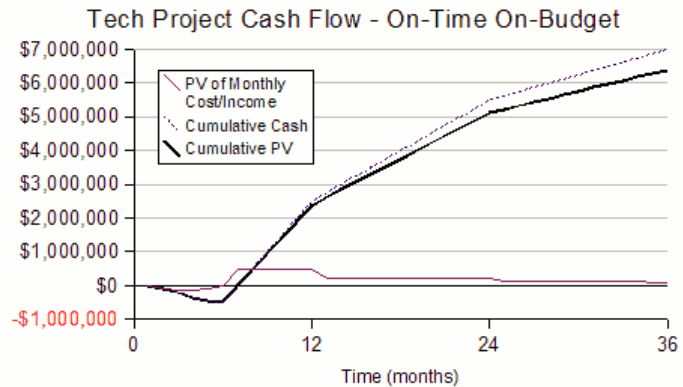


Exhibit 3: On-time delivery maximizes revenue and profit

The company believes that it can build the product in six months for \$500K. If successful, the project will be paid back in the first month's sales (month 7) and will return \$7MM in cash (\$6.4MM adjusted for TVM at 6%). This is a high-risk but high-return investment. See Exhibit 3 for the cash flow graph.

The project's profitability is incredibly sensitive to its schedule, however. If the project were to take six months longer, the TVM benefits of spending the cash more slowly at the start are completely overwhelmed by the cost of missing the early sales period. Payback is still relatively rapid, around month 14, but the total return is only \$4MM, or \$3.5MM adjusted for 6% TVM. If the project manager instead doubled the cost of the effort but kept the original six-month schedule, the payback period is two months after completion, around month eight. Allowing the product to take advantage of the full sales cycle keeps the total cash return at \$6.5MM (\$5.9MM adjusted for TVM).

Given the choice between keeping the budget constant and doubling the schedule, vs. doubling the budget to keep the schedule, it is far more profitable to sacrifice the budget. The extra cost is more than made up by extra sales.

Far more common in software development, though, is the effects of Brook's Law: “Adding manpower to a late software project makes it later.” (Brooks, p. 25) Cost overruns accompany schedule overruns far too often in high-tech industries. The damage to the business plan is incredible. If the project takes 12 months to complete and \$1MM, the payback period is around month 16. The total cash return is cut in half, to \$3.5MM or \$3.1MM adjusted for TVM (see exhibit 4).

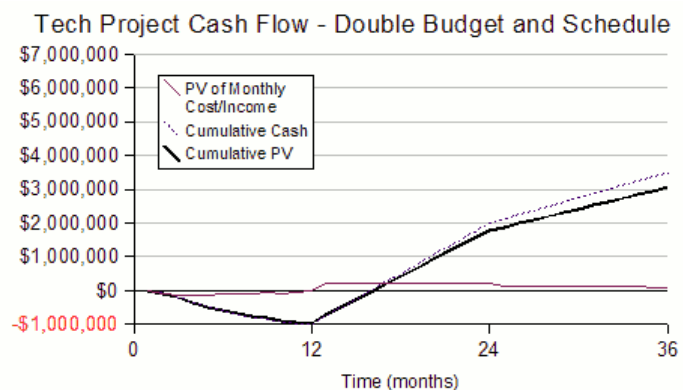


Exhibit 4: Delivering behind schedule dramatically hurts profitability

The effect of TVM on the cash flow projections is small for technology projects. The marketing and pricing issues involved

overwhelm their effects. The fast obsolescence of technology products mean that the cost of financing is a small consideration. How to keep the products marketable is a much more important issue. Often high-tech business plans will completely ignore the cost of capital, focusing instead on the product's potential market. Because these estimates are very uncertain, the business plans are extremely risky. Often the high profits from a few successful products are needed to fund the cost of many technical and marketing failures.

High-tech project managers are often frustrated by the unending schedule pressure applied by the sponsor. At times, the sponsor may seem to make irrational decisions, driving the project costs high for possible schedule improvements. At times, non-technical sponsors are seduced by unethical or uninformed people who promise that they can deliver the same product in far shorter time. Depending on the expected first-to-market advantage for the resulting product, these "irrational" decisions by project sponsors may be rational after all.

Using Financial Measures in Portfolio Management

Financial measures like total return, payback period, and time value of money can be very useful to understand a single project. Communication between sponsors and project managers improve when they can speak in common terms and understand the effect of each other's decisions on cash flow and schedule.

These measures are even more powerful when applied to a portfolio of projects. Often it is difficult to judge the relative value of projects which meet extremely different needs. Calculating their benefits in financial terms can help organizations to compare diverse projects. The cash flow schedule, payback period, and present value can all help senior managers compare a group of projects, determining which ones best meet the organization's financial objectives.

When comparing multiple projects, it is essential that the calculations be done on the same basis. Return on investment, for instance, is sometimes expressed as a simple ratio of net benefits (income minus costs) over total investment. Other times, it is calculated on an annualized basis, dividing the ratio by the number of years. ROI will vary dramatically depending on the time considered. By ignoring financing costs, a project can enhance its apparent return. By manipulating the estimated costs and returns for a project, it is possible to distort its business case significantly.

Organizations that choose to use financial measures to select and rank projects should set standards for the calculation of each measure. Financial and accounting professionals can often add rigor to these measures, and financial auditors can measure compliance with the standards. Establishing proper controls and accountability for both cost and revenue projections are essential to create an environment for ethical, accurate business cases.

Conclusion

Although the project manager and scheduler will not typically write full business case for a product or project, they should play an essential role in shaping it. Many organizations keep project managers and schedulers unaware of the expected returns of the project, focusing their attention instead on the project itself. Because scheduling decisions can have a dramatic impact on the business case for a project, it is worthwhile for the project manager and scheduler to become familiar with the overall business case for the effort. Sharing the business case with each other will help the sponsor, project manager, and scheduler make decisions that consider everyone's best interests.

References

Heerkins, Gary. (2005, January). *How to Prepare a Winning Business Case for Your Next Project*. PMI New Jersey Chapter Meeting, Monroe, New Jersey, United States. Summary available from <http://www.pminj.org/05-mtg/051njmtg.htm>

Brooks, Jr., Frederick P. (1995). *The Mythical Man-Month: Essays on Software Engineering, Anniversary Edition*.
Boston: Addison Wesley Longman.